The Electrical Industry's Weekly Magazine

November 12, 1956

Electrical World

Price 35 Cents

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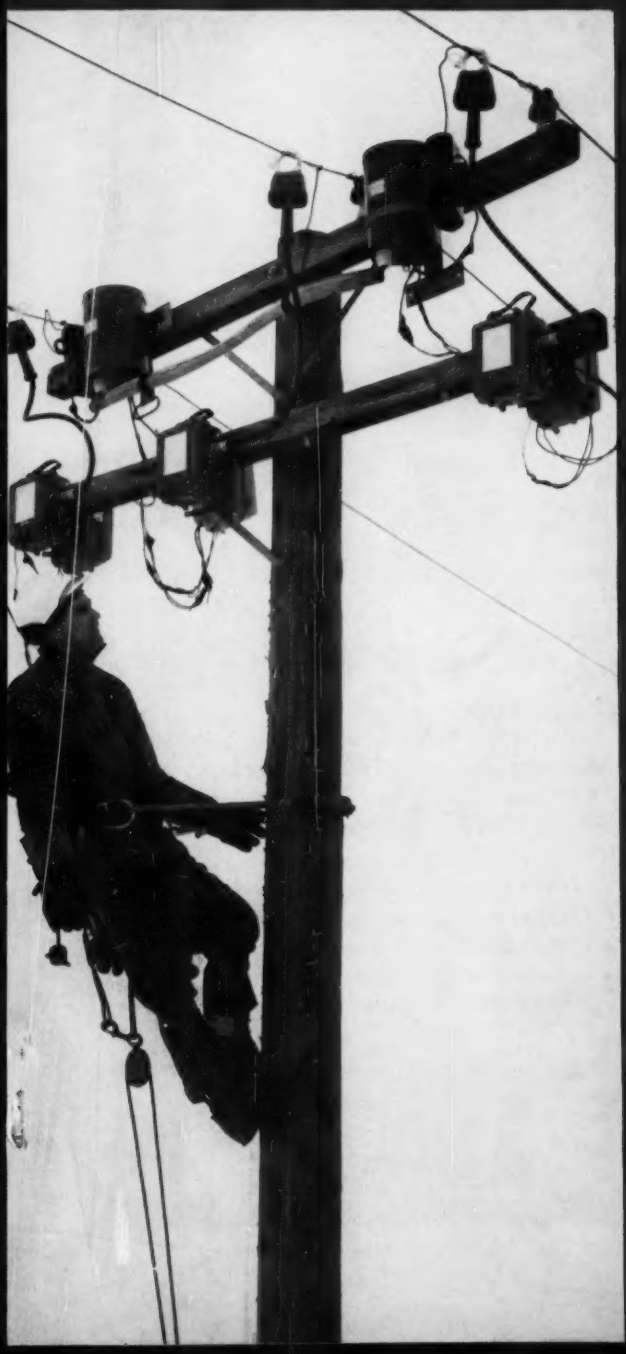

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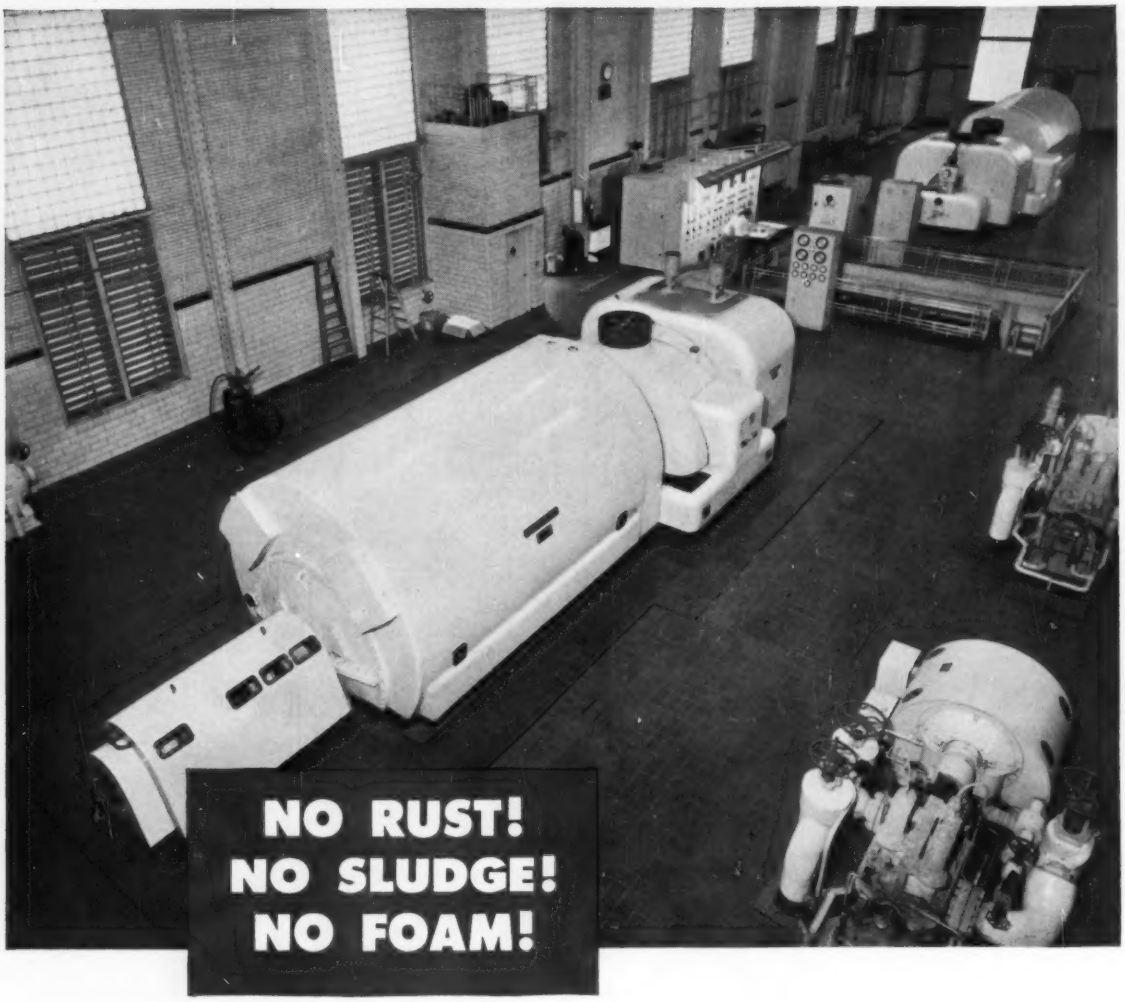

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Electrical World

Published for 82 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Vol. 146, No. 20 **November 12, 1956**

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Cable splices made faster, last longer in toughest "proving ground" here in The Bessemer Limestone and Cement Company's quarrying operation. Note the rough surfaces over which the cable is dragged. Under conditions that vary from extreme dryness to complete submersion, Bessemer reports exceptional results from the rugged splices made with Okonite Tapes.

Okonite Tapes reduce down-time for Bessemer shovels

The Bessemer Limestone and Cement Company has reduced down-time on its electric shovels two ways by using Okonite Tapes in splicing its high voltage portable shovel cables. First, tough, waterproof splices can be made in the field without taking the cable to the shop and without buying any special molds and other equipment. Second, splices made with Okonite Tapes have been in service since 1948 without added time-loss in remaking.

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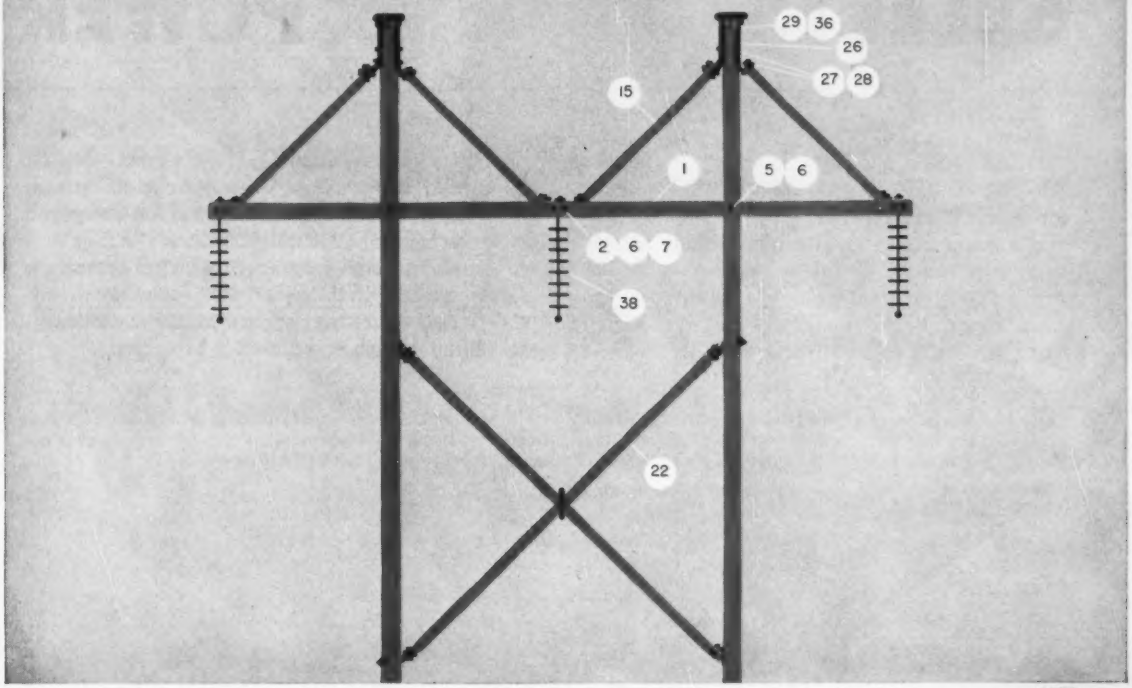
DRG. REF. #	QUANTITY	DESCRIPTION	DRG. REF. #	QUANTITY	DESCRIPTION
792	2	Pole	15	4	Vee brace 3⅜" x 4⅜" cross section
1	2	Crossarm	22	1 set	Cross brace w/fittings, clamp, ⅞" pole bolts and curved washers
2	3	Steel spacer fitting w/mounting bolts	26	2	Static wire support
5	2	Stud bolt ⅞" w/washer nuts	27	4	Machine bolt ¾"
6	8	MF locknut ⅞"	28	4	MF locknut ¾"
7	1	Bent stud bolt ⅞" x 8" w/2 sq. nuts	29	2	Clevis
			36	2	Suspension clamp for static wire
7	2	Bent bolt ⅞" x 5½" w/sq. nut	38	As required	Suspension insulators and fittings



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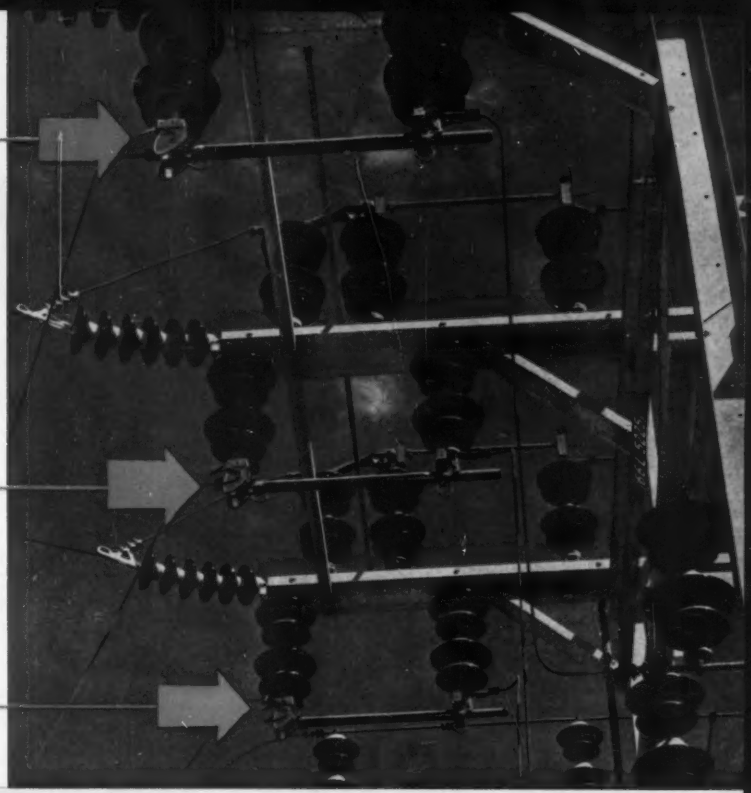
To satisfy these demands, Florida Power & Light has carried on an extensive power expansion program which, by the end of 1955, will have required the investment of $250,000,000 since V-J Day.

For an expansion program of such importance, it is only natural that the greatest possible care is used to make sure that service continuity is maintained and system equipment is protected.

Aerial view of the Hialeah section of Miami—one of the areas where rapid building of homes and industry has increased demand for light and power to six times what it was ten years ago. Hialeah Park is nationally famous . . . open the year around . . . host to hundreds of thousands annually.

COMPANY FUSES



For example, S&C Drop-Out Power Fuses—Type SMD (marked by arrows, right) are installed at Hialeah substation to protect two 7500 kva 69/13 kv transformers which serve Hialeah Park as well as the hundreds of homes and many small industrial plants which surround it.

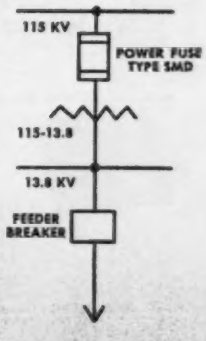
How S&C Power Fuses Are Used in the 69 Kv and 115 Kv System Protection Schemes

The transmission lines of Florida Power & Light Company are tapped at intervals to feed distribution substations. As was originally planned, the power transformers were not always provided with primary protection against secondary faults since primary breakers could not be economically justified.

After a 115 kv power transformer had been lost (for lack of such protection) the matter of protection was reconsidered. It was then decided that this protection was essential and that the device selected must meet these special requirements.

1. Provide system protection over a wide range of fault currents.
2. Coordinate with the transformer damage curve to provide maximum protection to the transformers.
3. Give complete coordination with secondary protective devices over the full range of fault currents.
4. Be capable of withstanding the recovery voltages which might be encountered under various fault conditions.
5. Be low in cost.

S&C Power Fuses, Type SMD, were found to meet all these requirements. Further details of Florida Power & Light's application of these fuses may be found in AIEE Paper No. DP 55-405.



Typical substation tapped directly from Florida Power & Light's transmission lines.

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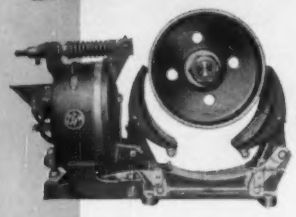
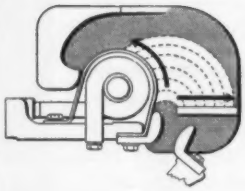
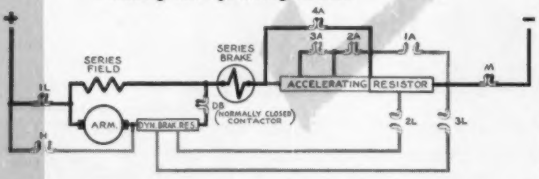


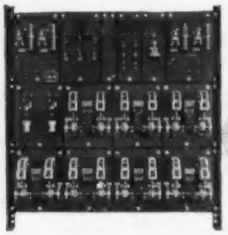
LONG-LIFE BRAKES for cranes operated by A.C. or D.C. power. High speed performance. Low upkeep.



CONTACTORS operate on the LINE-ARC principle. No destructive burning of arc shields. Cool contacts and reduced maintenance.

DYNAMIC LOWERING CIRCUITS for hoist motions. Respond quickly. Permit accurate inching for spotting loads.





REVERSING-PLUGGING CONTROL for bridge and trolley motions. Automatically controlled acceleration. Only one adjustable relay for plugging.

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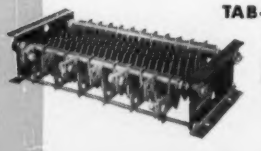

TAB-WELD PLATE RESISTORS —spot-welding provides a continuous path, and keeps resistance value constant.

MANUAL-MAGNETIC DISCONNECT SWITCHES are very easy to operate. They are arranged to control crane lights, too.

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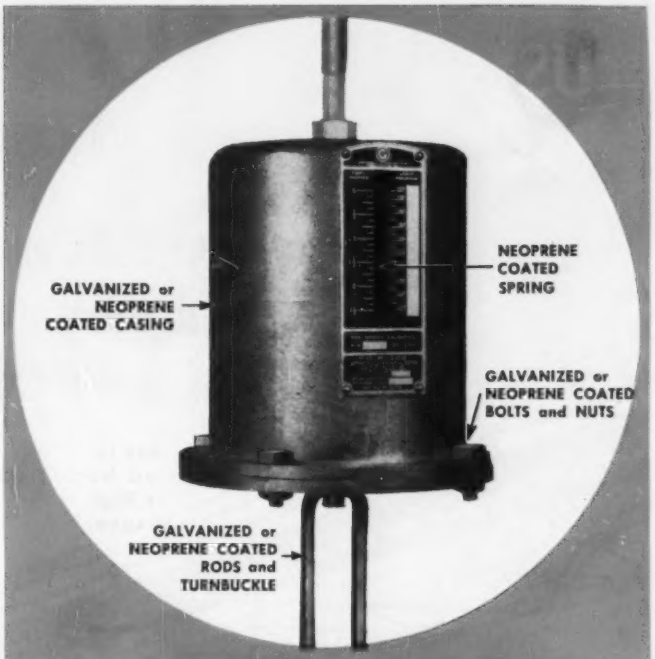
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NEOPRENE COATED SPRING
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GALVANIZED or NEOPRENE COATED RODS and TURNBUCKLE

Another Grinnell First!

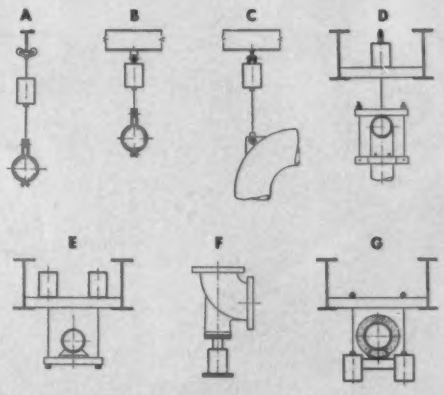
Grinnell pre-engineered spring hangers are now offered in two new lines to meet the need for spring hangers in installations subject to highly corrosive industrial conditions and to severe weather exposure.

These hangers are the result of extensive experimentation with various coatings for Grinnell's standard pre-engineered spring hangers. In addition to providing flexibility in pipe suspension, they provide versatility of application through their corrosion-resistant characteristics. They are . . .

1. Neoprene coated — for highly corrosive conditions such as those found in chemical plants and refineries. *All* parts of the hanger are neoprene coated to protect the base metal from a wide range of corrosives. The flex life of the spring is unaffected by the neoprene . . . the coating resists cracking or flaking over a wide temperature range.

2. Galvanized — for outdoor installations where weather conditions are severe. All parts of the hanger are galvanized except the spring, which is neoprene coated to avoid alteration of temper, hydrogen embrittlement and decreased flex-life of the spring — usual hazards to springs from the galvanizing process.

AVAILABLE IN 7 TYPES FOR THESE TYPICAL APPLICATIONS



(A) Rod threaded to top cap (B) Furnished with single lug (C) Two lug style (D) Top adjusting (E) Adjustable top and bottom (F) For floor support (G) Trapeze assembly.

Along with the obvious advantages of such corrosion and weather-resistant characteristics, consider these features...

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- Installation is simplified by integral load scale and travel indicators.

*Precompression is a patented feature.

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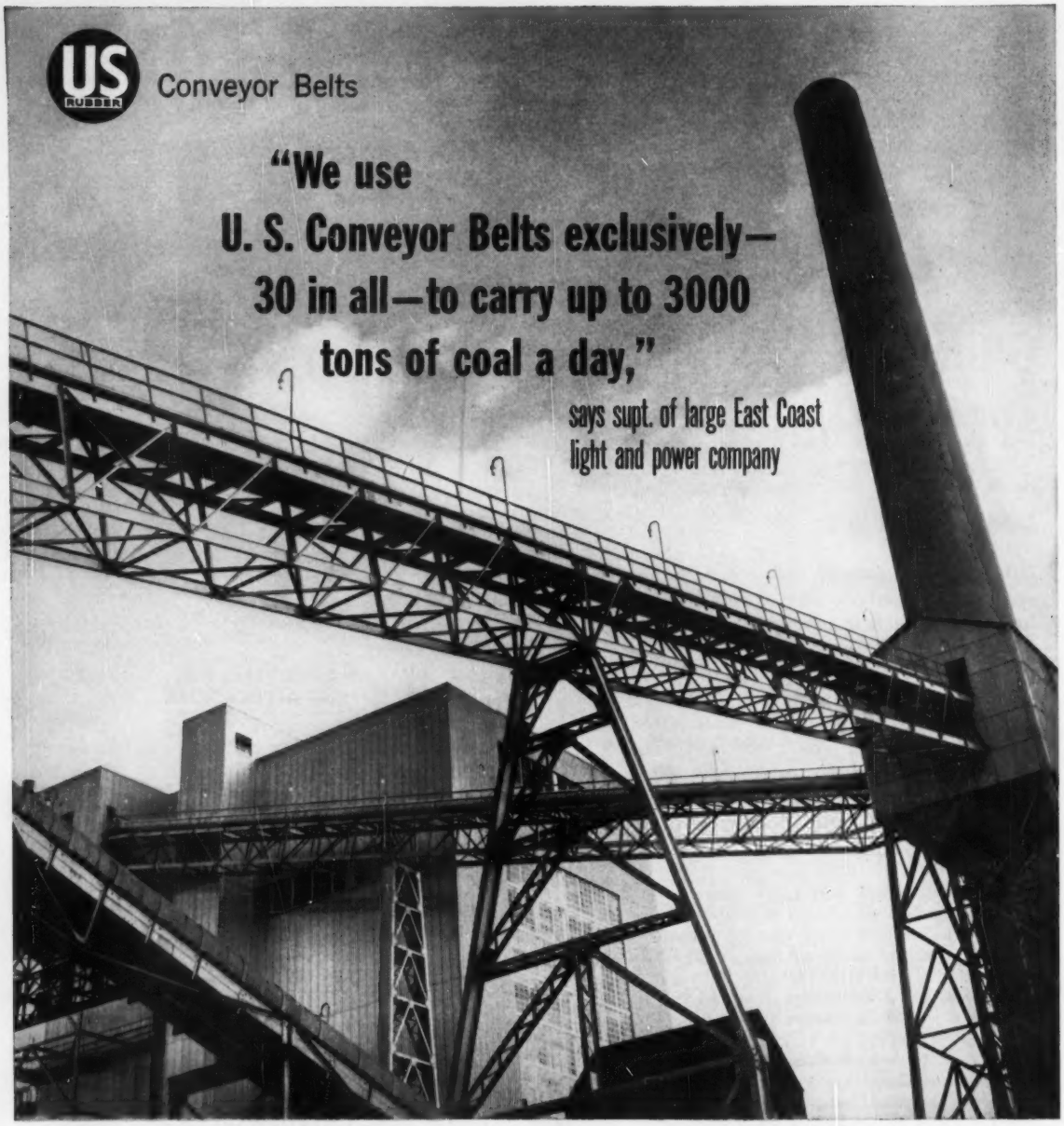
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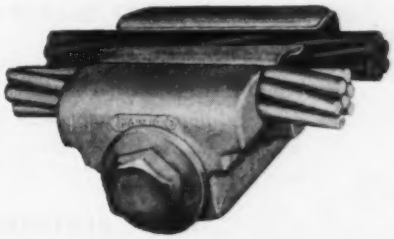

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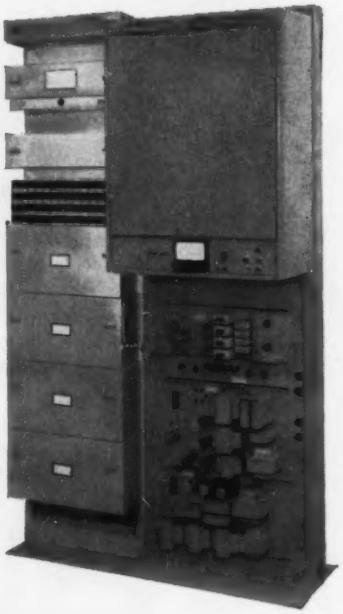
- **Extendable to 40 hops (1000 miles)**
- **Commercial quality circuits**



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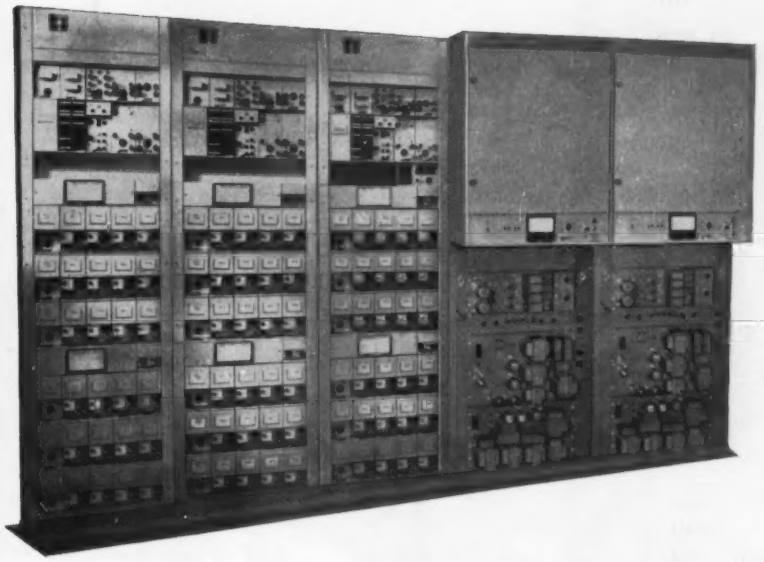
- **Expandable to 24 or more channels (plus service channel)**
- **Extendable to 10 hops**
- **Commercial quality circuits**

Microwave "Packages"



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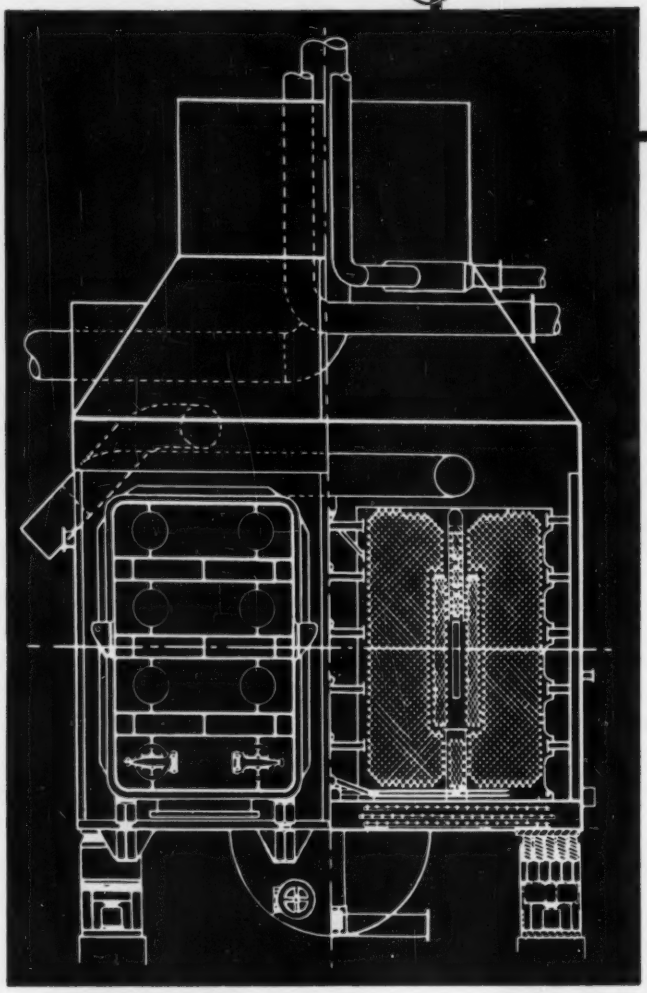

- Specifically designed for larger, more efficient electric generating stations.
- Adaptable to your station layout.
- Designed to minimize field erection problems.
- Additional steam lanes shorten path and resistance to steam travel.
- Lower pressure drop and higher vacuum.
- "Zero" condensate temperature depression.
- DEAERATION . . . 0.01 cc per liter is attainable.
- Purity of condensate.

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C. H. WHEELER MANUFACTURING CO., 19th & LEHIGH, PHILADELPHIA 32, PA.

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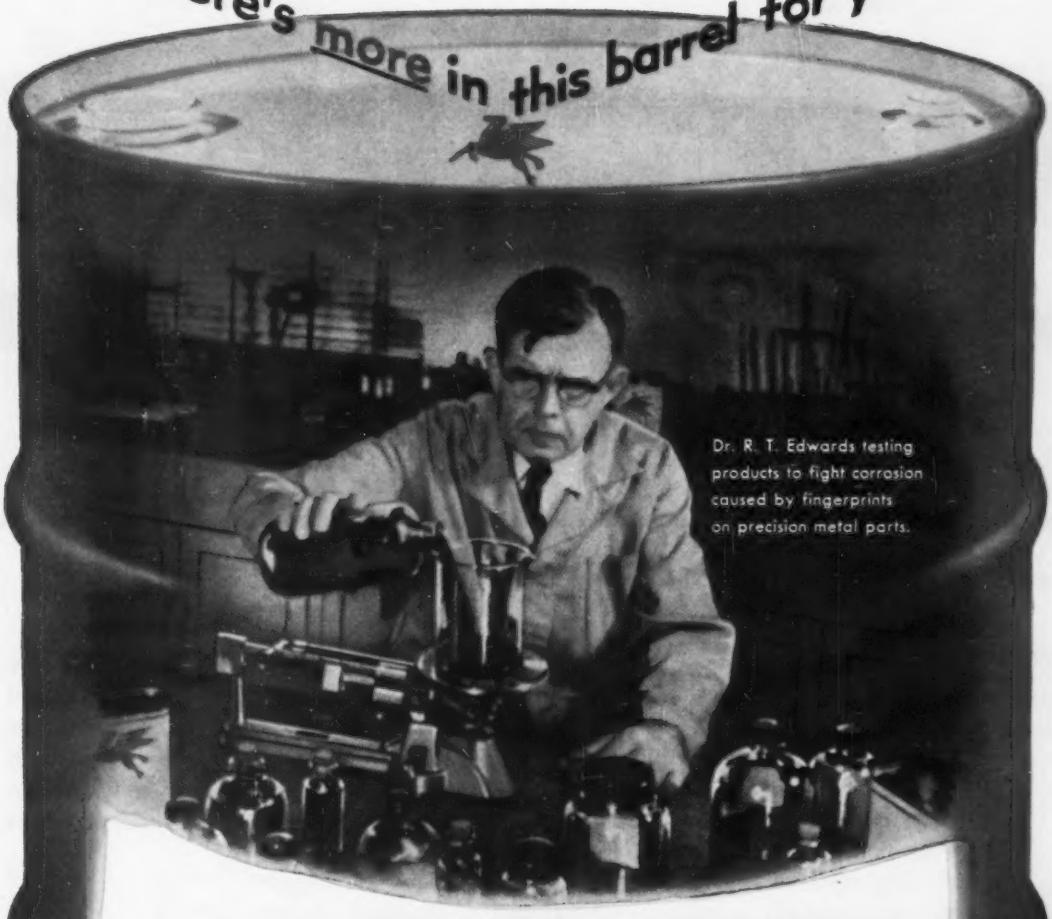
WE 607

C.H. Wheeler OF PHILADELPHIA

There's more in this barrel for you...



Dr. R. T. Edwards testing products to fight corrosion caused by fingerprints on precision metal parts.

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to help you improve production and cut costs!

When you specify "Socony Mobil," you get petroleum products backed by *more continuous research* than those of any other oil company! This means products which are *continually improved* in quality and performance—*new* products when needed. Equally important . . . these complete research facilities are available to *you*—to help improve your production and lower your unit costs.

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RILEY TURBO

solves six major central

Problem 1: **How to eliminate slagging on furnace walls and on other heating surfaces.**

Solution: Intertube Directional Flame Burners used with the Riley TURBO FURNACE are placed on one elevation, immediately above the furnace floor and are arranged for opposed firing. Combustion is substantially completed at the bottom of the combustion chamber. The upper furnace envelope area serves the purpose of cooling combustion gas to the required temperature for superheater and reheater. Combustion gas rises vertically in the secondary furnace without stratification and without impingement on furnace walls.

Problem 2: **How to reduce carbon loss to the minimum.**

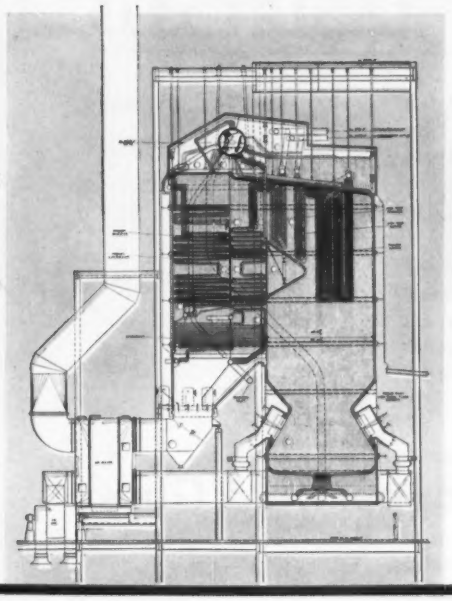
Solution: The combustion zone of the Riley TURBO FURNACE is a chamber of high temperature, long residence time, and extreme turbulence. Here pulverized coal particles are completely consumed with most of the ash reduced to molten slag.

Problem 3: **How to eliminate flyash disposal.**

Solution: The almost negligible trace of flyash carried in the flue gas of the Riley TURBO FURNACE is collected in rear pass hoppers and dust collectors and reinjected thru the burners for reburning of combustibles and final disposal as molten slag. Molten slag is quenched and removed as in any conventional slag tap furnace.

Problem 4: **How to change from gas and oil to solid fuels firing at less cost.**

Solution: Conventional type steam generating units designed to burn gas or oil must be taken out of service for extensive and costly alterations when converting to solid fuels firing. Because furnace exit gas temperatures are substantially the same for all fuels fired in the Riley TURBO FURNACE, immediate conversion to solid fuels without change to furnace and heating surfaces is possible.



FURNACE
station problems

Problem 5: **How to obtain uniform heat distribution to steam heating surfaces.**

Solution: The vertical direction of combustion gas leaving the TURBO FURNACE burning zone uniformly within the area of the vertical furnace walls insures equal furnace exit gas temperature from side to side and front to rear. Uniform heat absorbtion by superheater and reheater elements is thus assured.

Problem 6: **How to reduce operating costs.**

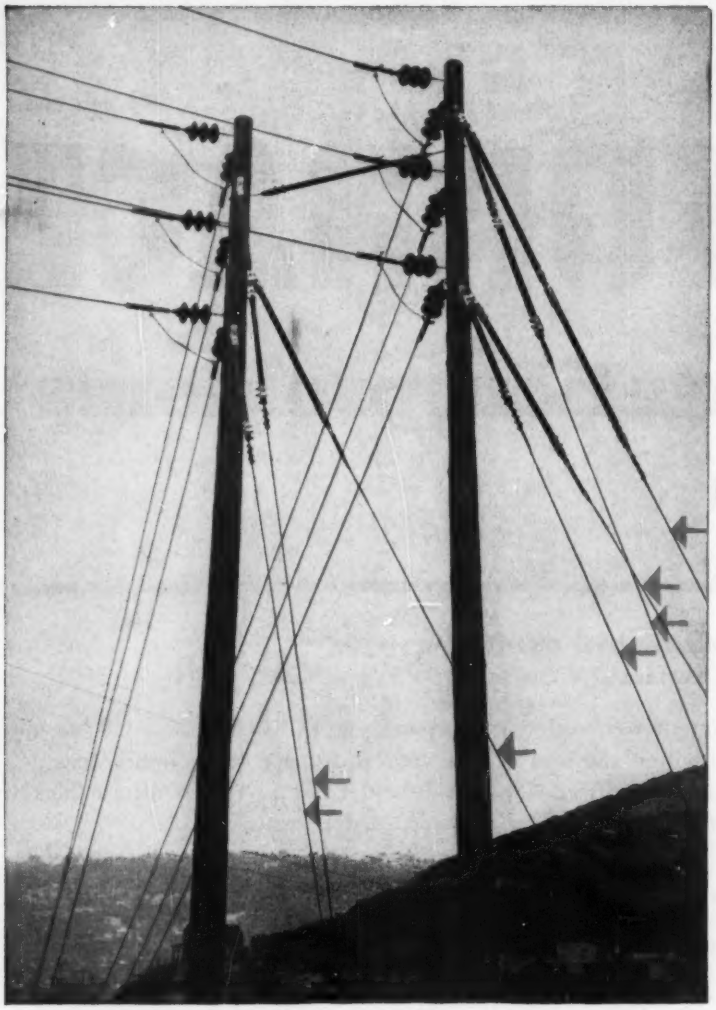
Solution: Burners on large conventional central station boilers are usually placed at several levels requiring complicated facilities for operation and supervision. Riley's TURBO FURNACE Directional Flame Burners are all located near the bottom of the furnace on one level. Plants can be designed so that the turbine, burner platform and control room are all on one floor level. Complete automatic electronic burner controls with fool-proof safeguards against flame failure are available for remote operating control.

Riley TURBO FURNACE boilers have been sold for capacities over one and one half million pounds of steam per hour. The operating characteristics of Riley TURBO FURNACES assure effficient performance when burning coal, oil, fluid coke, delayed coke, gas and lignite individually or in combination.

A survey of your plant by a consulting engineer could show ways of making surprising savings in your power costs.

RILEY
Stoker Corporation
WORCESTER, MASSACHUSETTS

Sales Offices: Worcester, New York, Philadelphia, Buffalo, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Houston, Denver (Englewood), Salt Lake City, Los Angeles, San Francisco, Portland, Seattle.



These "new" Copperweld Guys are 30 years old —and still going strong!

Installed 30 years ago, these Copperweld* Guys are as "new," safe, and strong today as the day they were put up—still good for many more years of dependable, maintenance-free service.

Unusual? Not for Copperweld. When it's up, it's up to stay—an advantage of vital importance to every operator of overhead lines.

Non-rusting Copperweld Strand, with its permanent high strength, matches pole life—eliminates guy repair and replacement costs. And, when you consider that the price of the guy strand is such a small part of the total installation cost, it's false economy to use anything but Copperweld—the best guy strand available.

*Trade Mark

non-rusting Copperweld TRADE MARK

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION *Glassport, Pa.*
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

GUY STRAND

***The Best* in Terms of Safety and Service!**

ELECTRICAL BUSINESS OUTLOOK

Electrical World
NOVEMBER 12, 1956

Copper prices aren't likely to climb back to the high levels of early 1956. Recent price advances on the London Metals Exchange and here at home by custom smelters apparently are nothing more than "war jitters". Actually, the world-wide copper market is so weak that it won't support higher prices. The only thing that will change this picture will be a spreading of the middle east conflict.

Oil prices, on the other hand, will be greatly influenced by events in the Arab world. Reports coming in now indicate that Europe's oil supplies from the middle east will dwindle to a trickle within a very short time. As domestic producers are called in to take up the slack you can expect a build up in pressure for higher prices.

• • •

Housing starts are expected to go even lower next year. A recent survey by the National Association of Home Builders indicates builders generally expect a 10% drop in housing starts next year. If this materializes, housing starts will drop to around 990,000—about 110,000 under this year. It will be the first time new home construction has dropped below a million since 1949 when only 900,000 new homes were put up.

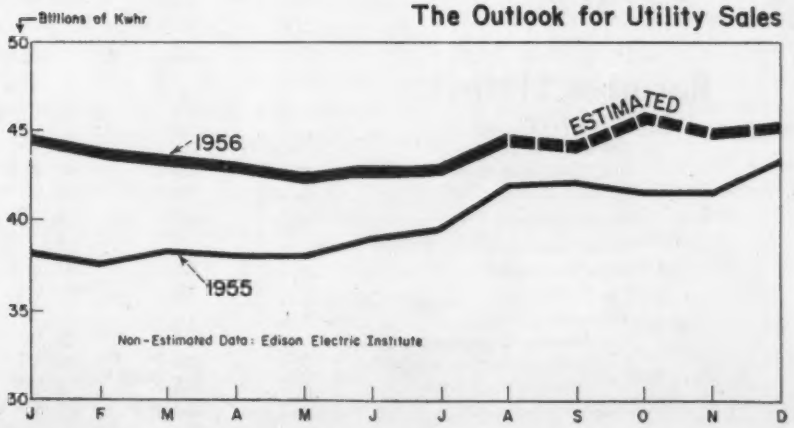
Higher price tags in the shadow of tight mortgage money will be big dampers on the new home market. At this point it doesn't appear that the tight money situation will ease before the second half of next year at the earliest. And then it will only come if industry eases off on its capital spending.

• • •

Sales of major electric appliances will boost utility sales by better than 45 billion kwhr per year by 1961 if Hotpoint Co's sales forecast (EW, Oct. 22, p 57) is realized. By 1966 additional sales will push residential consumption up another 44 billion kwhr.

Utility sales in August were under EW estimates (below) for the first time this year. Preliminary August figures show sales at 44.9 billion kwhr—almost 2% under the estimated 45.8 billion kwhr. The only other month close to falling short of the estimate was July, when sales were 0.2% under the estimate of 43.1 billion kwhr. However, actual sales in both months are surprisingly high when you consider they cover the period of the steel strike which occurred during an unusually cool summer.

The Outlook for Utility Sales



STATISTICS

More Than 94% of Farms Have Electric Service

	Total Farms (Thousands)	Farms with Electricity (Thousands)	(Per Cent)	% Increase
1955	4,782*	4,507**	94.2	1.3
1954	4,782*	4,448	93.0	5.6
1950	5,382	4,214	78.3	51.1
1945	5,859	2,788	47.6	37.2
1940	6,097	2,032	33.3	141.6
1930	6,289	841	13.4	85.7
1920	6,448	453	7.0	

*Nov. 30, 1954
**June 30, 1956

Source: U. S. Dept. of Agriculture

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity, Peak—Class 1 Systems, Estimated Dec. '56 Peak — million kw	July	117.54	117.50	108.79	8.0
	July	94.8	97.0	89.3	6.2
	Aug.	106.10	106.09	103.83	2.2
Production—billion kwhr	July	49.45	49.45	46.63	6.0
Hydro		9.91	10.05	9.35	6.0
Fuel		39.54	39.40	37.40	5.7
Sales—billion kwhr	Aug.	46.11	44.57	43.37	6.3
Residential		11.60	11.38	10.52	10.3
Commercial		7.95	7.74	7.40	7.4
Industrial		23.78	22.71	22.76	4.5
Other		2.78	2.73	2.68	3.7
Fuel Consumption	July				
Coal—million tons		12.00	12.34	11.74	2.2
Oil—million barrels		4.32	4.61	4.63	−6.7
Gas—billion cu ft		136.97	127.04	127.62	7.3
Net Income Class A & B Co's—$ million	Aug.	97.17	96.86	93.14	4.3
Residential Customers—millions	12 mos.	45.10	44.99	43.84	2.9
Revenue per kwhr	ended	2.61¢	2.62¢	2.66¢	−1.9
Avg kwhr per customer	July 31	2,899	2,879	2,662	8.9
Avg annual bill		$75.66	$75.43	$70.81	6.8

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Sept.	145	142	142	2.1
ENR Construction Cost	Oct.	147.6	147.8	141.3	4.5
BLS Cost-of-living	Sept.	117.1	116.8	114.9	1.9
New Orders for Machinery (1950 = 100)	Aug.	142	146	124	14.5
NEMA Sales					
Insulation materials	Aug.	153	117	147	4.1
Electric appliances		100	111	101	−1.0
Wholesale prices	Aug.				
Motors and generators		133.3	133.1	121.8	9.4
Transformers and regulators		139.7	134.5	127.3	9.7
Switchgear and fuses		153.8	152.6	139.2	10.5
GNP—annual rate—$ billion	2nd Qtr.	408.3	403.4	387.4	5.4

Your Business

How the day goes. Iowa Public Service Co figures that its employees spend only 43 minutes of an eight-hour day earning dividends. The remainder is spent paying off the cost of doing business. Here's how it goes: It takes nearly 2½ hours to pay for fuel costs. Without a break for coffee, the next hour and 38 minutes of toil are required to pay all types of taxes. During the remaining part of the afternoon, an hour and 25 minutes goes for wages, 30 minutes goes for materials and supplies, 40 minutes goes for depreciation, and 36 minutes goes for miscellaneous costs.

Device to prevent loafing. Back in 1925 the patent office issued a patent on a measuring device designed to keep tabs on factory machine operators. One objective of the device was said to be "to prevent a workman from succeeding in an effort to deceive his employer by running his machine without subjecting it to working loads." The scheme involved use of a clock and an electromagnet for stopping and starting the clock. The clock was tripped on when the machine operated under a work load. Thus a record could be kept of the time the plant machine was producing each day.

Your Health—High Blood Pressure

REX H. WILSON, MD, Medical Director, B. F. Goodrich Co

Hypertension (high blood pressure) is one of our foremost problems. It is prevalent in both sexes over 40. While there are more than 50 diseases that cause a rise in blood pressure, the cause is actually known in about 10% of the cases. These are called primary or essential hypertension.

When your blood pressure is taken there are two readings—an upper one and a lower one (160/90). You have hypertension if the lower one is persistently elevated over 90 m.m. of mercury. The upper reading may be as high as 160 plus.

There are many factors in blood pressure elevation. There can be resistence to blood flow caused by spasm or disease of the blood vessels. If your ancestors had high blood pressure, your chances of having it are greater. Statistics indicate short stocky people are more prone to have it.

Certain kidney diseases can cause high blood pressure. It may occur as a result of changes in kidney circulation. Certain types of systemic vascular and heart disease can cause a rise. Narrowed hardened arteries are a cause because the blood flow is hindered. Certain brain diseases are accompanied by elevated blood pressure. The blood pressure may be elevated in pregnant women. Emotional and nervous stress and strain are factors. One aid is to put the patient at ease.

It is difficult to draw the line between normal and abnormal blood pressure. Age, time of day, amount of food we eat and daily stresses and strains must all be taken into account. Blood pressure is constantly varying. It rises in most persons with increasing age, yet in some older persons the pressure goes down. Many 60-year-olds have low blood pressure in spite of hardened arteries and other aging changes.

Treatment depends upon the amount of elevation and its cause. Your kidneys, heart, blood vessels, glandular system and brain should be investigated for abnormalities. If you have essential hypertension, your physician will advise you to get your weight within normal limits and to adjust to peaceful daily living. He has tranquilizing and sedative drugs to aid you. There are several drugs which will lower the blood pressure. A restricted salt intake or special diet may help.

People can endure relatively high blood pressures, but beyond a certain point they are in danger of vascular accidents such as "strokes" and "heart attacks". Elevated blood pressure is not a single disease with a "sure fired" pill to cure it, but it is a condition of many factors which requires careful treatment to enable you to live with it.

Our ancestors had high blood pressure and died from it. It seems as if we not only inherited our ancestors' woes, but have also added to them. The ability to relax and achieve peace and quiet is the mark of a successful person. Your physician can give you advice on how to live and medicine to help you do it, but only **you do the living.**

WASHINGTON COMMENT

What Reactor Safety Hearing Will Show

V. CRAIG RICHTER, Washington Correspondent

Some ground rules for future civilian atomic reactor proposals will be laid down during the public hearing into the proposed building of a fast breeder reactor by the Power Reactor Development Co near Detroit. With elections over, more public interest can be concentrated toward the hearings, which will begin Dec. 10.

These will be the developments to watch:

• How much technical and still classified information will be disclosed by Atomic Energy Commission witnesses to assure that the safety factor will be settled before any fissionable material goes into the area? Safety—or lack of it—is the ostensible reason for petition by the three Michigan labor unions opposing the construction permit to the Detroit Edison group.

• How will the hearing affect procedures for future hearings on applications? The questions up will include the role of intervenors, of documenting "public convenience and necessity", of the opportunity either competing applicants or citizen groups will have in such proceedings.

• Whether the whole pattern and fabric of public hearings on atom power plants will become so time-consuming and laborious that the AEC will come to a conclusion that perhaps some other group should take on at least that stage of government control.

Already there have been indications of concern over the amount of time AEC personnel is having to spend on this matter. It could very well be that AEC would be only too happy to see licensing obligations and the attendant problems turned over to a separate, new agency.

Democrats in Congress have proposed that such an agency be created once Congress returns in January. Chairman Lewis L. Strauss and the top AEC personnel have to date opposed such delegation of duties to a regulatory setup, say along the lines of the Federal Power Commission. But some of them may be more than willing once having experienced the laborious proceedings of a public hearing to let some one else do it.

Answers Must Be Theoretical

In the PRDC case certain areas of uncertainty will be spelled out. Further information has been requested of the builders on what steps will be taken to solve, for example, the bowing of fuel elements and the potential meltdown hazard. While the proposed answers to these problems may be as safe as it is possible to make them, the fact remains that they are still theoretical and must await final testing in the actual plant.

Another question brought forward by the PRDC case involves the precise use and value of construction permit. The permit itself is no guarantee that an operator's permit will be issued. It allows the builder no fissionable material. At least one high AEC official has contended that PRDC could have proceeded with these preliminary stages without an AEC permit. If this is so, then in the PRDC case and any other of these early projects, a possibly unnecessary step can be eliminated.

TECHNICAL NOTES

Distribution transformers buried in the ground can carry more than rated load. They also curtail noise and do not impair the appearance of a residential area.

Wave shape distortion in the current drawn by vapor-type street lamps can cause abnormal lamp performance and poor lighting.

Draining the boiler while hot and blowing air through it to promote drying eliminate moisture which otherwise would cause rapid attack on the metal during boiler shutdown.

Leads from hydroelectric generators are brought out the top of the units by a Southern utility and run in conduit to the switchyard. This practice shortens cable requirements and permits ready access.

Charging a customer $5 for immediate reconnection is being tried by Virginia Electric & Power Co to reduce the number of disconnections resulting from delinquent bills. As before, no charge is made if the customer is willing to wait a day or two.

Ungrounded industrial distribution, to provide the service continuity claimed for it, must include equipment to detect accidental grounds and personnel to clear them before a second ground can occur to trip out one or more circuits. But its service record can be considerably better than a grounded system.

all mobile radio users need this dependable receiver

for silent monitoring of Civil Defense alerts!

Rules and regulations of the FCC require every station in the Amateur, Standard Broadcasting, Public Safety, Special Industrial and Land Transportation Radio Services to observe all Conelrad radio alerts.

In buying equipment for Civil Defense monitoring purposes, you will want to have the most foolproof equipment. RCA's Type CR-17A Conelrad Receiver offers the following noteworthy features:

1. *Silent*, annoyance-free monitoring plus provision for audible monitoring and external alarm.
2. Automatic switching to preset Conelrad frequency in event of an alert.
3. In absence of radio signal, automatic switching between broadcast station and Conelrad "cluster" stations until signal from one or other is received.
4. Designed for continuous operation.
5. Two tuning sections—Section 1 is tunable to any frequency in broadcast band; Section 2 is preset to Conelrad frequency 640 or 1240 kc.
6. Supersensitive, permanent-magnet electro-dynamic speaker assuring fine performance and volume.
7. Fulfills requirements of Federal Communications Commission.

***Price in U.S.A., subject to change without notice.*

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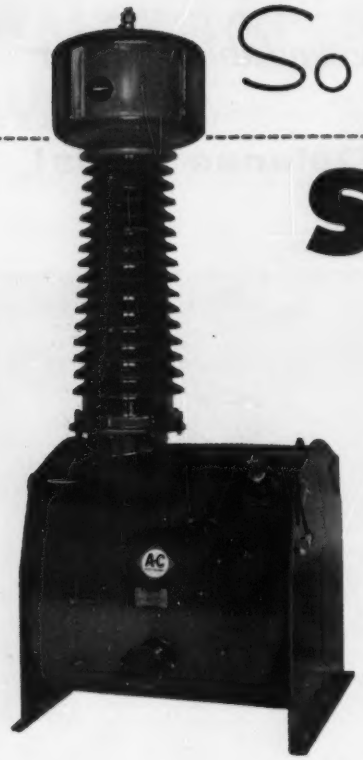

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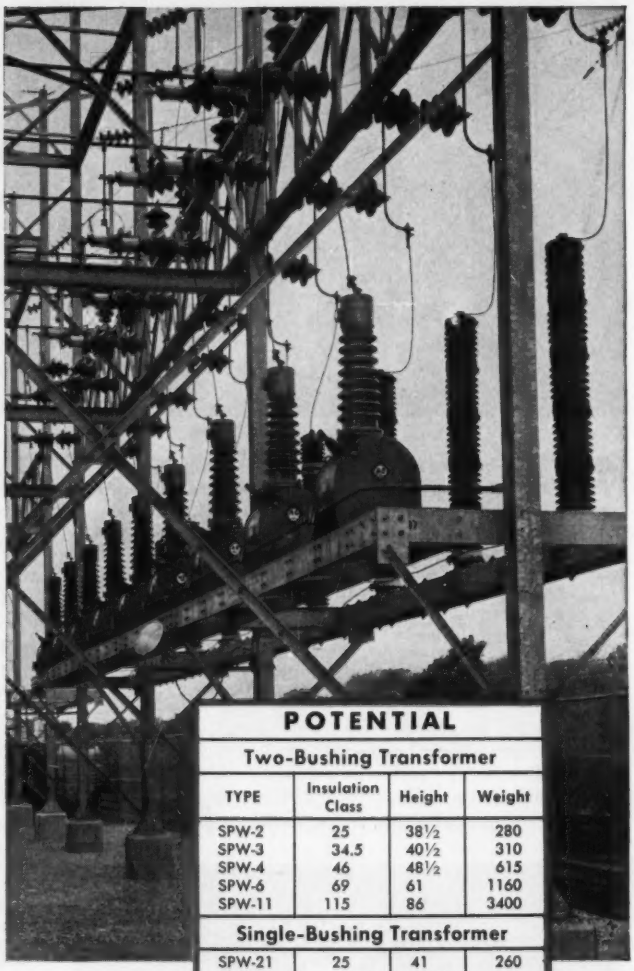
So *Easy* to Install



MUCH smaller and lighter than previous designs, new Allis-Chalmers potential transformers cut installation costs and provide maximum handling convenience. Less space and less foundation to mounting structure are required. A fork truck or block and tackle is all that is needed to lift these 69-kv units into position. And, of course, relocating is accomplished just as easily.

Performance has also been improved in both ratio and phase angle with the advanced design of Allis-Chalmers potential transformers.

Many other design features — features that assure unparalleled dependability and long life — have been incorporated in these modern units. Get the complete story from your local A-C representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

POTENTIAL

Two-Bushing Transformer			
TYPE	Insulation Class	Height	Weight
SPW-2	25	38½	280
SPW-3	34.5	40½	310
SPW-4	46	48½	615
SPW-6	69	61	1160
SPW-11	115	86	3400
Single-Bushing Transformer			
SPW-21	25	41	260
SPW-31	34.5	44¼	285
SPW-41	46	50¾	460
SPW-61	69	63¾	950
SPW-111	115	92	2310
SPW-131	138	112	3510

New Ratings have been added to the Allis-Chalmers line of potential transformers to include higher voltage insulation classes.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

A-5164

You can pull these plugs at full load . . . SAFELY!

Circuit-Breaking Arktite

PLUGS AND RECEPTACLES

20 amp. to 400 amp.—250V D.C.; 600V A.C.

SAFE at all times—even if you pull an *Arktite* plug to disconnect an energized motor or appliance in an emergency!

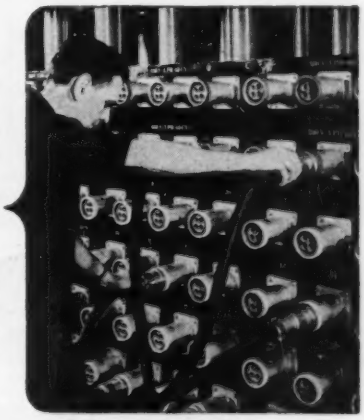
You don't have to open the disconnect switch before withdrawing an *Arktite*. Arcs created as line and load poles disengage are confined in deep, insulated arcing chambers—are instantly snuffed out by pressure-deionization and lack of oxygen. There's no possible danger of flashover injuring personnel or destroying property.

Contact your Crouse-Hinds Distributor, nearest Crouse-Hinds Office or Representative for complete information.

NEW, Re-Designed *Arktites*...

Feature new pressure connectors — new easier-to-wire 1-piece interior assemblies — new easier-to-interchange plug and receptacle interiors — new plug adaptability to any type and size cable.

Fully interchangeable with older style. Same price. Currently available in 30 and 60 amp. sizes, in 2-, 3- and 4-poles.



Operated like a giant switchboard, this *Arktite* installation with variations in power, frequencies and voltages is used to speed up machine tool testing. Plugs can be inserted and withdrawn from "live" receptacles without using a disconnect switch.

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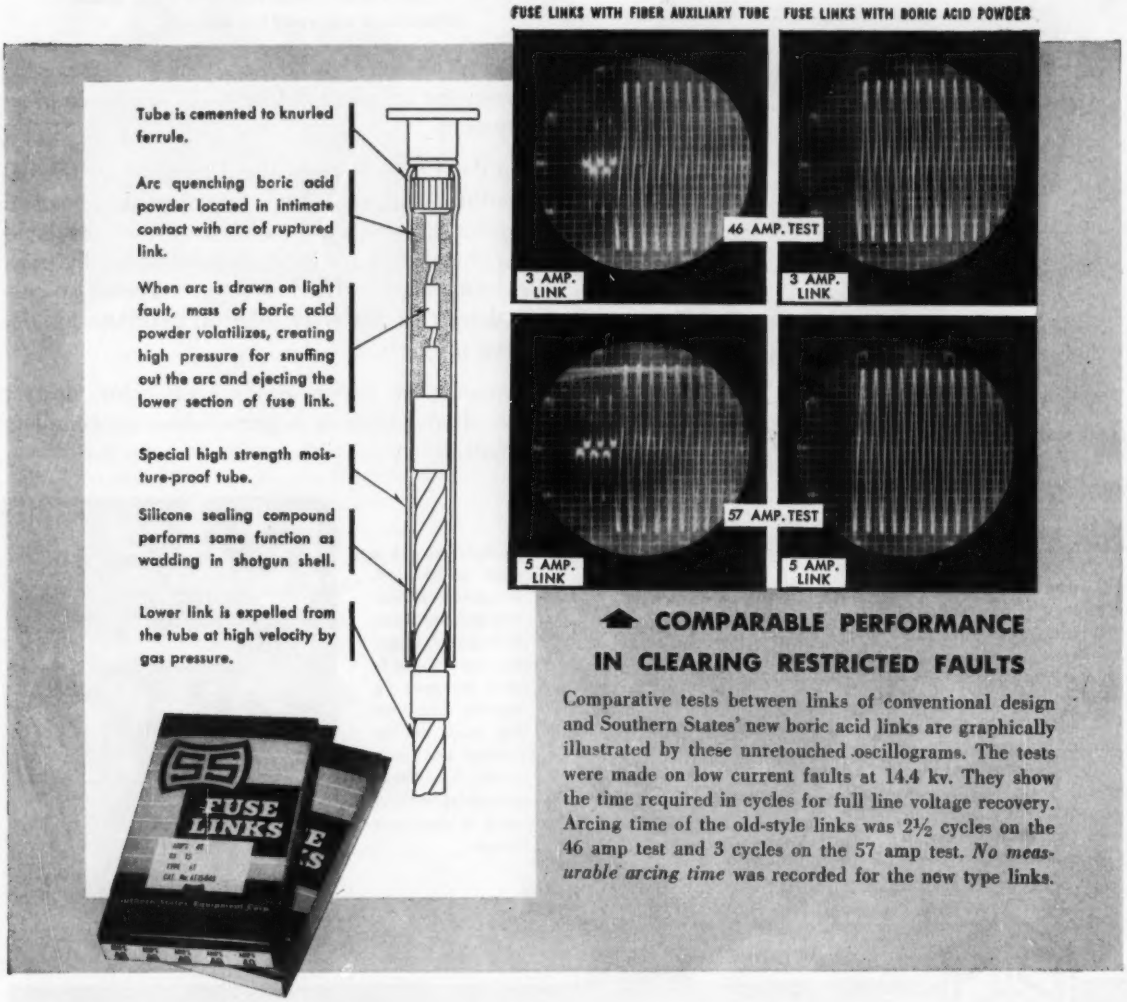
SOUTHERN STATES FUSE LINKS SOLVE PROBLEM OF LOW FAULTS

The problem of clearing restricted faults can be effectively eliminated by using Southern States boric acid fuse links. Even when using large bore cutouts, a low-magnitude fault can be cleared with little arcing.

As the illustration below shows, boric acid powder is in intimate contact with the fusible element. When the link ruptures, the mass of boric acid volatilizes, building a vapor pressure high enough to quench the arc instantly.

The added protection afforded by boric acid links virtually eliminates the possibility of cutout failure when called on to operate in the low current range.

Standard construction features of these links include: silver plating of all external metal parts . . . high-strength crimped joints . . . low-melting temperature elements . . . and moisture-resistant auxiliary tubes. You get a stronger link, more resistant to corrosion, and more dependable than ever.


Tube is cemented to knurled ferrule.
Arc quenching boric acid powder located in intimate contact with arc of ruptured link.
When arc is drawn on light fault, mass of boric acid powder volatilizes, creating high pressure for snuffing out the arc and ejecting the lower section of fuse link.
Special high strength moisture-proof tube.
Silicone sealing compound performs same function as wadding in shotgun shell.
Lower link is expelled from the tube at high velocity by gas pressure.
SS
FUSE LINKS
FUSE LINKS WITH FIBER AUXILIARY TUBE
FUSE LINKS WITH BORIC ACID POWDER
46 AMP. TEST
3 AMP. LINK
3 AMP. LINK
57 AMP. TEST
5 AMP. LINK
5 AMP. LINK

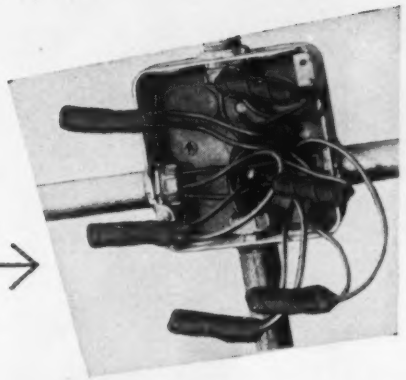
COMPARABLE PERFORMANCE IN CLEARING RESTRICTED FAULTS

Comparative tests between links of conventional design and Southern States' new boric acid links are graphically illustrated by these unretouched oscillograms. The tests were made on low current faults at 14.4 kv. They show the time required in cycles for full line voltage recovery. Arcing time of the old-style links was 2½ cycles on the 46 amp test and 3 cycles on the 57 amp test. *No measurable arcing time* was recorded for the new type links.

SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

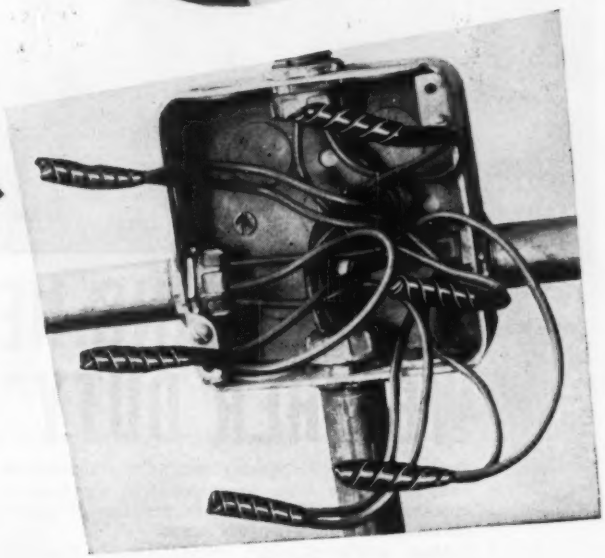
IN CANADA: Dominion Cutout Co., Ltd., Toronto

Avoid this



use this

for results like this . . .

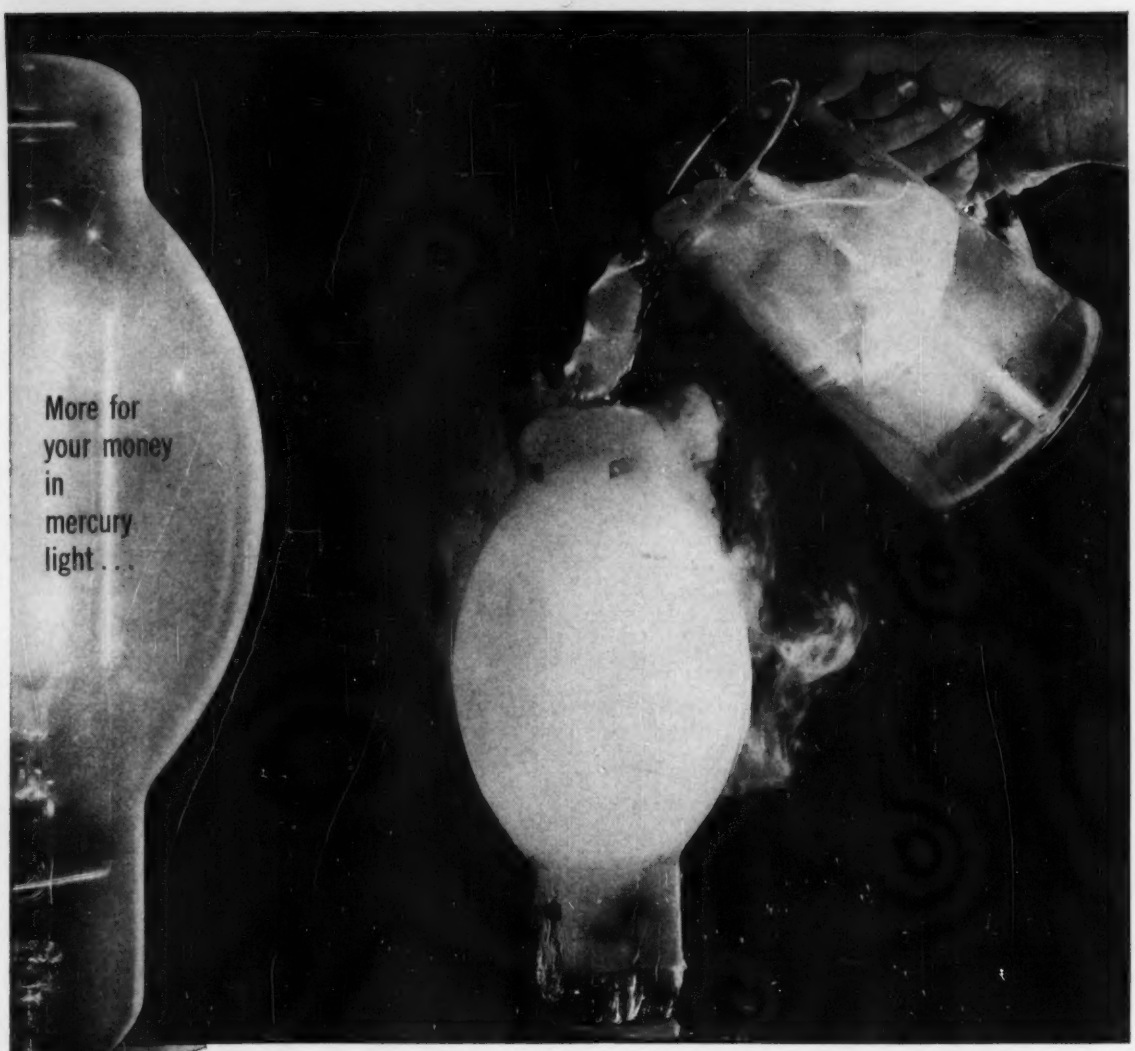


For neat, sure insulation without bulk, use Porter vinyl electrical tape. One operation does the job. No outer wrapping needed. Dielectric strength stands up to high voltages. Resistant to acids, water, corrosion. Conforms readily to curves. Retains adhesion under toughest service conditions. Ideal for production line and maintenance work. Order from your Quaker distributor.

Porter Vinyl Electrical Tape carries Underwriters' Laboratories Inc. seal

H. K. PORTER COMPANY, INC

HKP **QUAKER RUBBER DIVISION**
PHILADELPHIA, 24, PA.
QUAKER PIONEER RUBBER DIVISION
PITTSBURG, CALIF.



ANNOUNCING NEW WESTINGHOUSE WEATHER DUTY(TM) MERCURY LAMPS

Down again go your lighting costs as Westinghouse announces another basic improvement in high-intensity mercury lamps. It's the world's first line of *weather-resistant*, heavy-duty mercury lamps.

Made with hard, tough, thermally stable glass, new Westinghouse WEATHER DUTY Mercury Lamps can be burned outdoors unprotected in rain, snow or sleet with no risk of cracking. And they can be burned indoors in ventilated fixtures with no danger of shattering under water drops entering through the ventilating openings. Moreover, they are highly resistant to mechanical breakage and to the corrosive effect of industrial fumes.

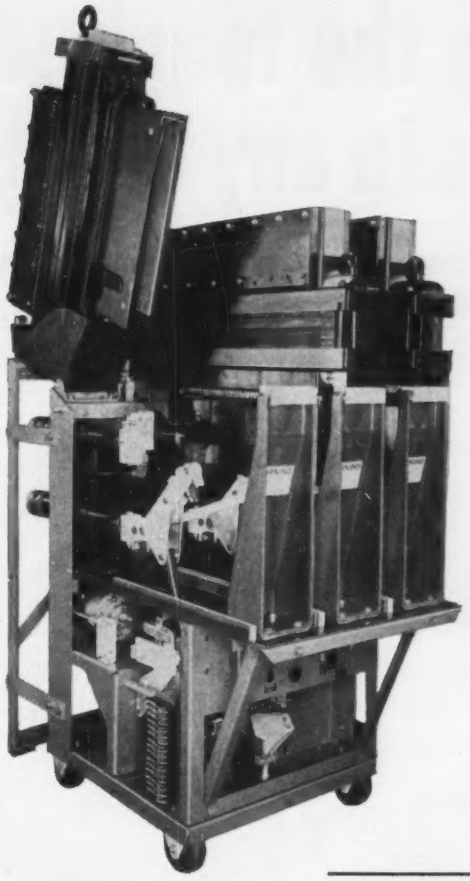
Thus in any type of installation—indoor or outdoor—Westinghouse WEATHER DUTY Mercury Lamps save you money three new ways. First, by eliminating the need for protective shields and permitting the use of cheaper fixtures. Second, by doing away with costly shield maintenance. And third, by releasing the large amount of light wasted by dirty shields.

WEATHER DUTY Mercury Lamps are the latest example of how Westinghouse gives you "*more for your money in mercury light.*" Now available types E-H1-WD, J-H1-WD, A-H12-WD, C-H12-WD, A-H15-WD and B-H15-WD.

WESTINGHOUSE GUARANTEES the service life of all its widely used types of quartz mercury lamps. For full details call your Westinghouse Lamp Representative—or write Westinghouse Lamp Div., Dept. EW-3, Bloomfield, N. J. "You can be sure if it's Westinghouse."

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU***



A Complete Line of I-T-E Metal-Clad Circuit Breakers for Every Application

Anticipating the proposed addition of three new higher metal-clad switchgear ratings, I-T-E now has a complete line of circuit breakers which are fully developed and tested to meet every requirement.

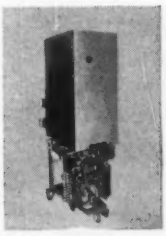
New 75 mva interrupting rating for I-T-E metal-clad switchgear applied on 4.16 kv systems

New 350 mva interrupting rating with a new 3000 amp continuous rating for application on 2.3 or 4.16 kv systems

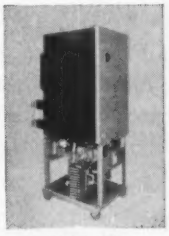
New 750 mva interrupting rating for application on 13.8 kv systems at 1200/2000 amp continuous

I-T-E Type	Continuous Amperes	Rated KV	Interrupting MVA
5HV-75	1200	4.16	75
5HV-150	600-1200-2000	4.16	150
5HV-250	1200-2000	4.16	250
5HV-350	1200-3000	4.16	350
7.5HV-250	1200-2000	7.2	250
7.5HV-500	1200-2000	7.2	500
15HV-150	600-1200	13.8	150
15HV-250	1200-2000	13.8	250
15HV-500	1200-2000	13.8	500
15HV-750	1200-2000	13.8	750

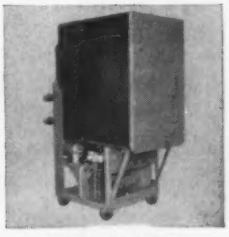
Note: These ratings require no change in I-T-E compartment dimensions.



5HV-75



5HV-350

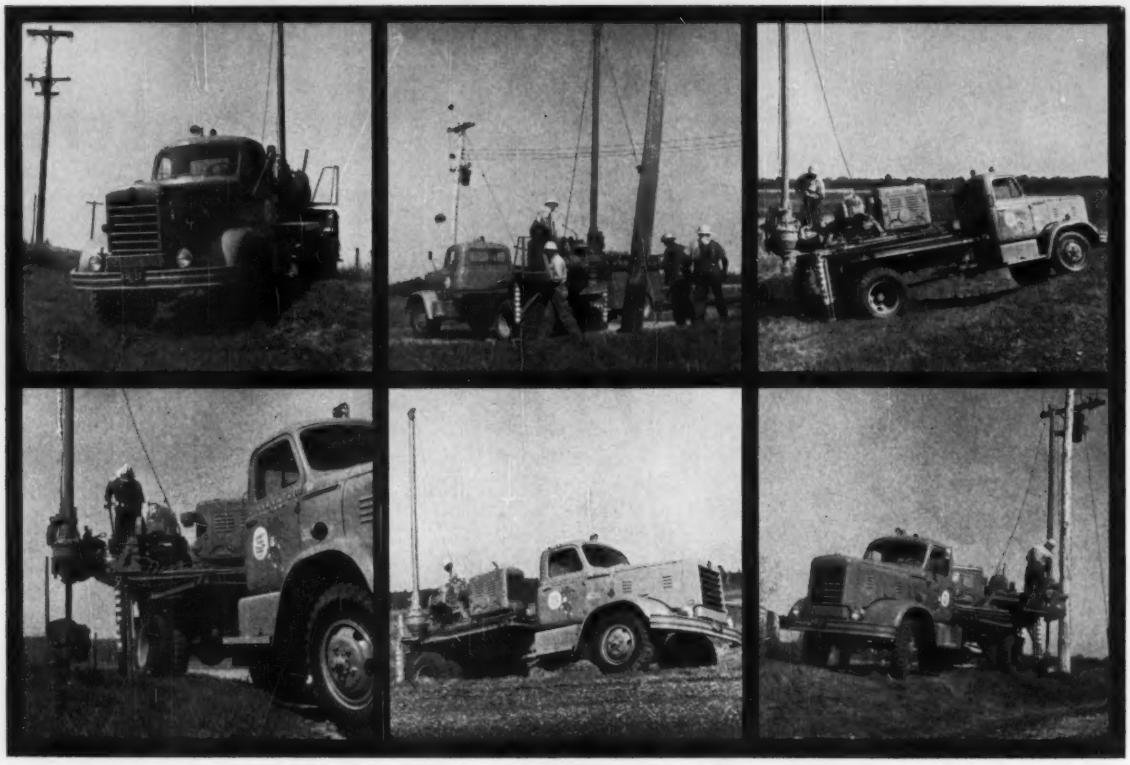


15HV-750

For complete information, call your nearest I-T-E sales office. Or write I-T-E Circuit Breaker Company, 19th & Hamilton Streets, Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

FWD doesn't skip the tough jobs ...works anywhere in any weather



When the shortest distance between two pole jobs is cross-country . . . you need FWD! New FWDs save time because you don't have to look for the level, easy way to get there. With FWD's unmatched power and traction you can travel straight to the job and do it, no matter how tough the terrain or weather. FWD is the only truck that is ready for line trouble emergencies—anywhere, anytime!

There's an important difference built into FWDs. They have full time, *true* four or six-wheel drive with both power *and* weight proportioned to each driving axle. This is the only way you are assured that every pound of weight is utilized to produce the kind of tractive power that doesn't skip the tough jobs . . . works anywhere in any weather!

FWD

Heavy-Duty Vehicle Specialists

THE FOUR WHEEL DRIVE AUTO COMPANY · **Clintonville, Wisconsin** · *Canadian Factory* · Kitchener, Ontario

The flexibility of conduit of Tenite Butyrate permits it to be curved in installation, eliminating the need for many ell fittings.

Brookville Telephone Company selects plastic conduit of Tenite Butyrate for its flexibility and smooth walls

The Brookville Telephone Company, Brookville, Indiana, had to install approximately 280 feet of cable conduit between two poles, in a location which would ordinarily have required the use of many right angle fittings. Seeking an easier and faster method, the company selected conduit of Tenite Butyrate, extruded by Yardley Plastics Co., Columbus, Ohio. This Eastman plastic has the flexibility to curve around most corners and obstacles, and presents the smooth inside walls necessary for fast, easy cable pull-through.

In making the installation, a two-foot deep ditch was first opened. Then, lengths of conduit of Tenite Butyrate were joined, using slip-sleeve couplings and solvent cement. As each section was added, a drag was inserted. The assembled conduit was next dropped into the trench, and the cable pulled through. Backfilling completed the installation. The entire job was finished in a fraction of the time usually required with metal conduit.

Conduit of Tenite Butyrate has other advantages, too. It's amazingly light in weight (one man can easily handle three 20-foot sections of 4" diameter), yet has high impact strength. It can be cut with a hand saw, and requires no threading. And it is unaffected by corrosion or electrolytic action of soil.

These are just some of the reasons why conduit of Tenite Butyrate is proving so successful in carrying both telephone and electric cables. For a booklet giving more information and a list of manufacturers supplying pipe and fittings made from this versatile Eastman plastic, write: EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

TENITE
BUTYRATE
an Eastman plastic

The light weight of Tenite Butyrate conduit makes it easy to handle.

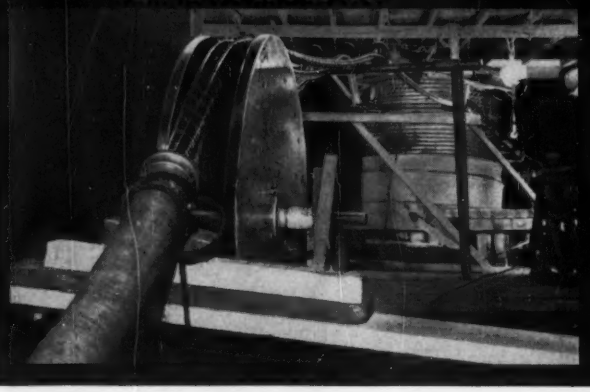
Slip-sleeve couplings and solvent cement are used to connect lengths of Butyrate conduit. No need for threading.

Drags and cable slide through easily, thanks to the smooth walls of Tenite Butyrate conduit.

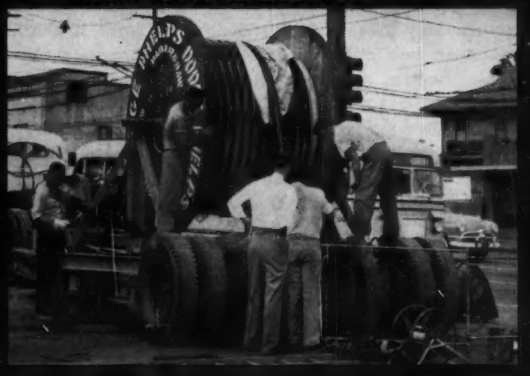
Phelps Dodge

WIDEST RANGE OF HIGH

Pipe Type, Compression Cable, from 15 KV to 230 KV.



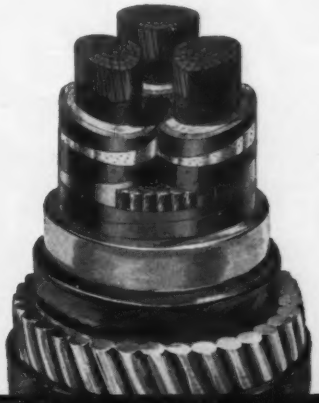
Low Pressure, Oil-Filled Cable, from 15 KV to 230 KV.



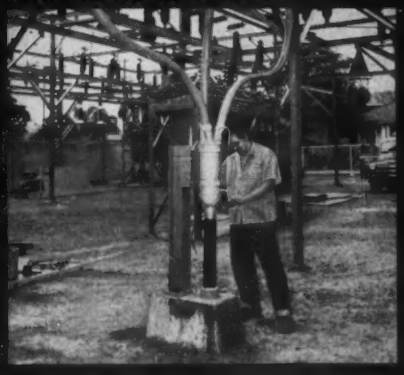
Consult Phelps Dodge for the correct answer to your requirements, regardless of voltage or type!

offers Industry's VOLTAGE POWER CABLE!

Only Phelps Dodge has manufacturing experience and operational "know how" with the entire range of high voltage cables which includes: oil compression, gas compression, high pressure oil, high pressure gas, pipe type cables; medium pressure gas, low pressure oil-filled, low pressure gas, submarine and solid type cables.



Low Pressure, Gas-Filled Cable, from 15 KV to 44 KV.



Submarine Cable, from 15* KV to 35 KV.

Solid Type Cable, from 15* KV to 69 KV.

*Lower voltage cables in this class also available.

PHELPS DODGE COPPER PRODUCTS CORPORATION

300 PARK AVENUE, NEW YORK 22, N. Y.

If Paul Revere galloped through Lexington

His way would be lighted with POWER

from **Pole Star**

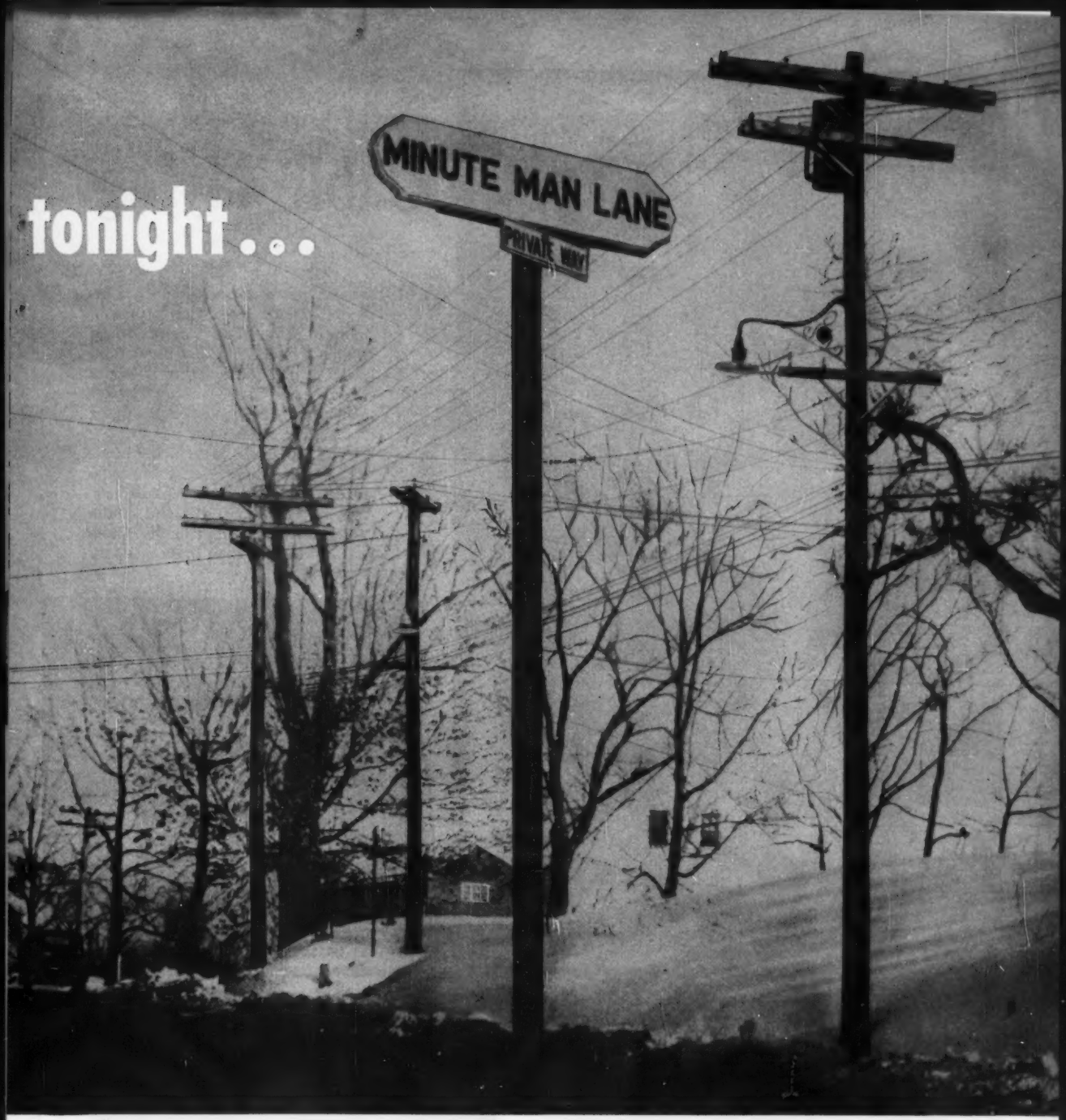
DISTRIBUTION TRANSFORMERS

Pole Stars are available in all single phase sizes from 3 through 500 kva, through 67,000 volts. Protected Pole Star Transformers are available through 100 kva.

Aroused and warned by the most famous nocturnal equestrian of all time, the Minute Men began forming to meet the oncoming British Redcoats during the early hours of the morning of April 19, 1775. The historic skirmish that took place a few hours later might be considered minor by present-day numerical standards (only eight were killed in the initial clash at Lexington, Mass.), but of course *many* things have changed in 180 years.

POLE STAR pt

PENNSYLVANIA



For example, if Paul Revere were to gallop through Lexington tonight, his way would be lighted with power from Pole Star Distribution Transformers. In fact, the pictured installation — on Massachusetts Avenue, across from Minute Man Lane, Lexington — is typical of many throughout the Boston-Lexington-Concord section, so that a large percentage of the territory covered on that famous midnight ride of yesteryear now is illuminated with power from Pole Star Transformers.

Pole Stars are serving as vital links in distribution systems throughout the *entire* United States — having gained nation-wide recognition in a period of just ten years. That's a short time from the historian's point of view, but it's long enough to prove conclusively that the Pole Star patented lap-on-top core *does* make a difference. Write for more details.

TRANSFORMER COMPANY CANONSBURG, PA.

A Mc Graw Electric Company Division *Greater Pittsburgh District*

Cable laying

LOCAL NEWSPAPERS seldom get excited over the laying of a submarine cable. But when Central Maine Power Company announced plans to link the island of Islesboro with a new 12,000-volt underwater cable, newspapers throughout the state covered the event.

The new cable, three inches in diameter and 2.3 miles long, was made in one length with no splices permitted. The cable, reel and cradle weighed *63 tons*, and in the whole area north of Boston there was only

Bath Iron Works' crane loads reel from flatcar to barge.

CMP officials check final armoring of cable at mill.

71-year-old "Seguin" stands by ready to help.

CMP crew boards launch during the pre-dawn hours.

makes headlines in Maine

one water-front crane (owned by Bath Iron Works) big enough to load the reel onto its barge. Even the tugboat was newsworthy; it was the venerable "Seguin," one of the oldest tugs on the coast, built in Bath 71 years ago.

The actual cable laying was directed by Al Young, CMP's Eastern Division line superintendent. Under radio control, the barge started off at daybreak to lay the cable in the 220-foot-deep (maximum) water. The laying took only three hours, and the barge reached the far shore at high tide (as calculated), so it could get close to the shore.

The Tiger Brand cable was made up of three No. 2 conductors covered with conducting fabric tape, $^{21}/_{64}$ inch of marine rubber insulation, color-coded fabric conducting tape again, then a tinned copper tape that furnishes additional shielding and also protects against the toredo or "ship worm." Saturated jute fillers and a binder of rubber-filled tape complete the core.

Two layers of asphalt-saturated jute are spirally applied in opposite directions, followed by the all-important No. 6 galvanized steel armor wires. A final asphalt coating is applied, then a layer of chalk to prevent sticking.

• • •

If you'd like more information about submarine or any other kind of high quality Tiger Brand cable, just call your American Steel & Wire salesman.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

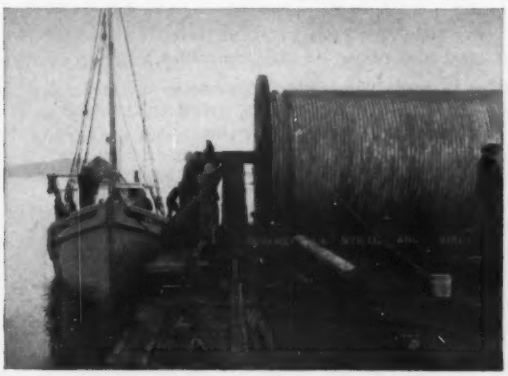
USS TIGER BRAND ELECTRICAL WIRE & CABLE

A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB

- asbestos wire and cable
- mold cured portable cord
- shovel & dredge cable
- paper & lead cable
- varnished cambric cable
- interlocked armor cable
- special purpose wire & cable
- aerial, underground and submarine cable

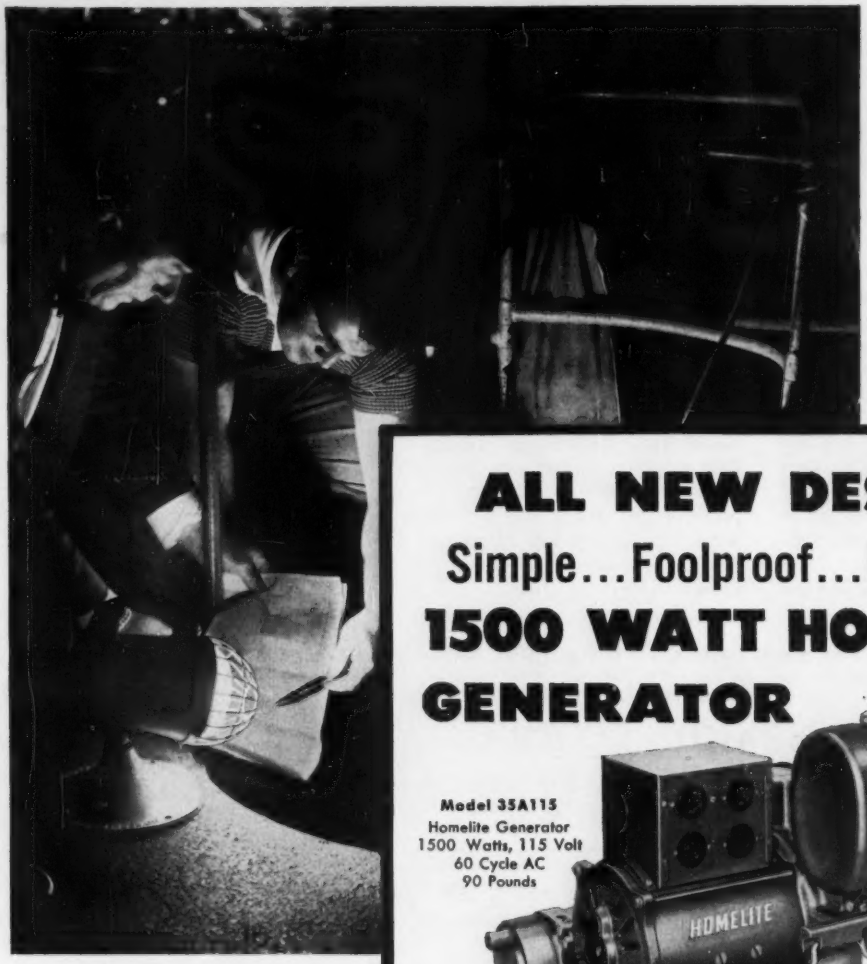
UNITED STATES STEEL

USS



Trawler maneuvers barge with reel into position.

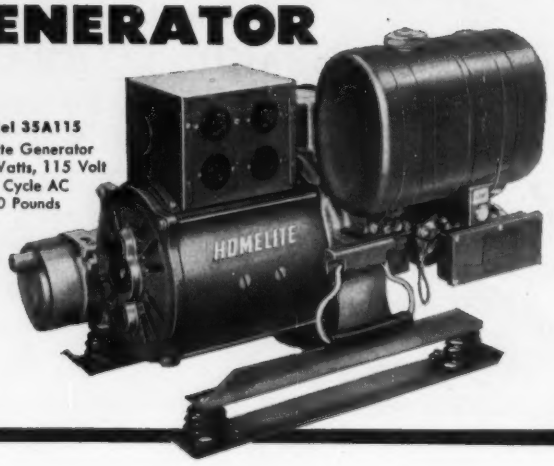
End of the line. Cable is trenched, potheads are on pole.



ALL NEW DESIGN!

Simple...Foolproof...Low Cost

1500 WATT HOMELITE GENERATOR



Model 35A115
Homelite Generator
1500 Watts, 115 Volt
60 Cycle AC
90 Pounds

Easy to Carry... ...Easy to Use

1. New Money-Saving Features . . . No DC brushes; just two easy-to-get-at collector ring brushes . . . No commutator or DC windings . . . No intermediate couplings; armature keys directly to shaft. Fewer parts to wear out — longer trouble-free generator service.

2. Constant Voltage . . . less than 4% change from no load to full 1500 watt capacity . . . assures long service life for your electric tools . . . guarantees top performance at all times.

3. Overload Capacity . . . 1500 watt continuous duty with generous overload capacity prevents tool stalling under heavy loads . . . insures uninterrupted service even when starting loads exceed operating loads.

4. Compact and Lightweight . . . one man can easily carry this generator wherever you need electricity to power time-saving electric tools. No need for long, hazardous power-consuming cables.

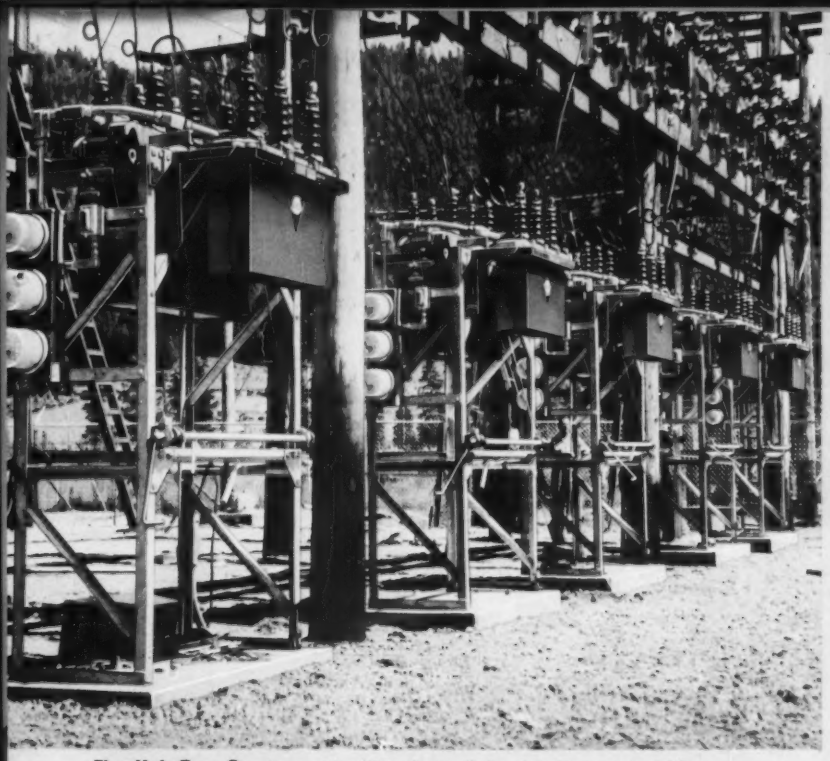
Whatever tools you want to operate — electric soldering irons, drills, floodlights, grinders, hammers, the new Homelite 35A115 generator can save you money. For a free demonstration or additional information, call your nearest Homelite representative.

SAVE EVEN MORE! New Homelite electronic idle control unit, available as optional accessory, runs engine at idle speed when no current is drawn . . . automatically brings engine to full speed when load is applied.

Ask your Homelite representative to show you how this easily-installed accessory reduces engine wear . . . increases service life . . . cuts fuel consumption.

HOMELITE *A DIVISION OF TEXTRON INC*
1811 RIVERDALE AVE., PORT CHESTER, N. Y.

Manufacturers of Carryable PUMPS • GENERATORS • BLOWERS • CHAIN SAWS



Five Kyle Type R reclosers with additional ground trip relay scheme are providing high-speed clearing on 13.8 kv distribution feeders of a 10,000 kva substation of the Washington Water Power Company, Wallace, Idaho.

Kyle Type E 23 kv reclosers have large contacts and oil cross-blast method of arc extinction. This makes it outstanding for high-voltage application.

Utilities Can Gain Greater Service Continuity and

Save Half a Million Dollars

with Kyle Reclosers

L-M Kyle reclosers offer large savings in initial investment and maintenance over circuit breakers as the feeder-disconnecting device in substations. In addition, Kyle reclosers offer large savings in the operating costs of the distribution system. These savings can amount to a half million dollars or more, as shown on the following pages.

How Operating Costs Are Cut

In addition to segregating permanent faults from the system, Kyle reclosers provide the high-speed circuit clearing required to reduce burndown for weather-proof conductors or annealing of bare conductors from transient or non-persistent faults.

With Kyle reclosers, it is possible to clear over 90 percent of total circuit faults and secure outstanding advantages such as:

Confining trouble to smaller areas.

Less serious damage to conductors and equipment.

Increased revenue because outages are reduced.

Greater service continuity.

Better public relations.

LINE MATERIAL Kyle® Reclosers

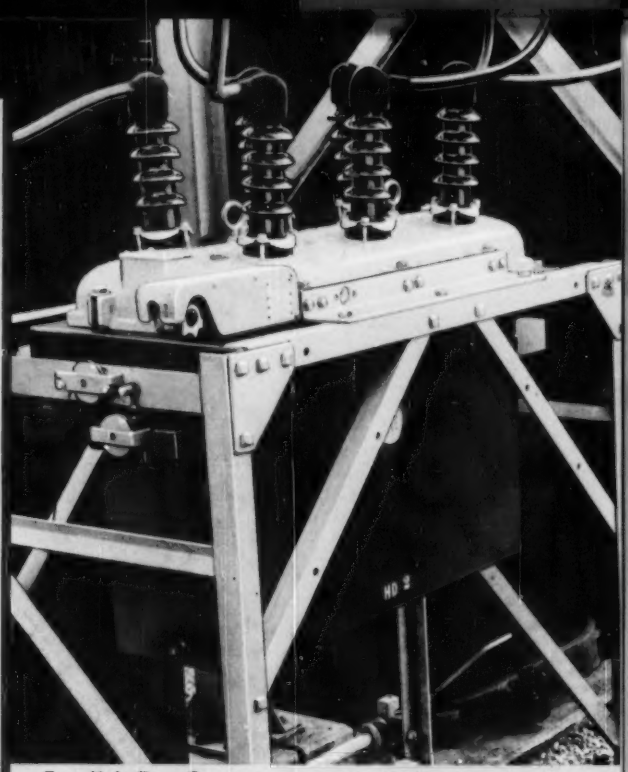
A McGRAW ELECTRIC COMPANY DIVISION

On the following pages are some facts and figures that will tell you how and why . . .

Analysis of Savings Using Kyle Reclosers for Five Years*

	Savings on 100 Substations	
I. Initial Investment Costs		
A. At substation. A Type R OCR as compared with an equivalent OCB with AC tripping and reclosing.		
1. Initial savings in equipment costs favoring each OCR—$3227.00. Total savings for 100 substations for 5 years— 2 x 5 x 100 x $3227/20	$161,350.	
2. Initial savings in labor costs to install transformers and wiring necessary to operate OCB—$30 per OCR. Total savings for 100 substations for 5 years— 2 x 5 x 100 x $30/20	1,500.	
Total initial investment savings with OCR's		$162,850.
B. On distribution feeders with 5 sectionalizing points per feeder.		
1. Equipment costs of 3 OCR's and 2 sectionalizers exceeding that of 5 fused cutouts = $491. Additional costs to utilize self-protective scheme for 200 feeders for 5 years = 5 x 200 x $491/20 (—)	$ 24,550.	
2. Labor costs of installations. OCR exceeding that of fused cutout = $15. Additional cost to utilize self-protective scheme for 200 feeders for 5 years = 5 x 200 x $15/20 (—)	750.	
Total additional costs of OCR's and sectionalizers over fused cutouts		— 25,300.
C. Net savings in initial costs with OCR's		$137,550.
II. Operating Costs (estimated 9 outages per feeder through transient conditions annually)		
A. Savings in frequency and duration of service trips resulting from transient faults		
40 man-hours @ $5/hr. per feeder	$200.	
25 truck hours @ $1/hr. per feeder	25.	
Cost of fuse links per feeder	5.	
Total cost of transient outages per feeder	$230.	
Total 5-year cost for 100 substations = 5 x 2 x 100 x $230	$230,000.	
B. Increased revenue resulting from reduced outages. 1500 KWH per outages per feeder for 5 years through loss of service @ 2¢ per KWH = 1500 x 2 x 100 x 5 x $.02	30,000.	
C. Total savings from transient fault protection for 5-year period		$260,000.
III. Maintenance Costs		
A. OCR and sectionalizer maintenance cost @ $25 per unit annually = $25 x 5 x 2 x 100 x 5 (—)	$125,000.	
B. OCB additional relay calibration costs @ $25 per unit annually = $25 x 2 x 100 x 5	25,000.	
C. Total additional costs of OCR and sectionalizer maintenance for 5 years		— $100,000.
IV. Carrying charges (conservatively estimated as 10% annually of initial capitalized investment)		
A. At substation. Savings represented by OCR's = ($3227 + $30) x 2 x 100 x 5 x .10	$325,700.	
B. On line, additional cost of automatic scheme = ($15 + $491) x 2 x 100 x 5 x .10 (—)	50,600.	
C. Savings in carrying charges with OCR's and sectionalizers		$275,100.
V. Subtotal		$572,650.
Additional savings resulting from Transient Fault protection		
VI. Savings realized by elimination of conductor and equipment damage through extra-fast clearing on heavy faults		$?
VII. Value of improved public relations realized through better continuity of service		$?
VIII. TOTAL SAVINGS		**Well over half a million dollars!**

**Costs are conservative estimates based on the best available information from utilities. System used to illustrate average installation consisted of 100 substations each with two 15 kv feeders, and amortized in 20 years.*



Two Kyle Type R reclosers are providing high-speed clearing of 13.8 kv feeders for transient fault protection and automatic disconnecting of permanent faults with minimum substation investment.

How Heavy-Duty Substation

The application of Kyle reclosers as the automatic disconnecting device in substations eliminates the relatively high costs of circuit breakers and associated substation equipments. This alone offers savings of a half million dollars or more in five years, based on 200 feeder positions.

Lower Initial Costs

Initial investment in Type R recloser equipment of equivalent rating will result in approximately $3,000 savings per feeder. In addition, field reports indicate that labor for installing Type R reclosers is about 50% of that for circuit breakers. The maintenance cost for reclosers is also lower than for circuit breakers.

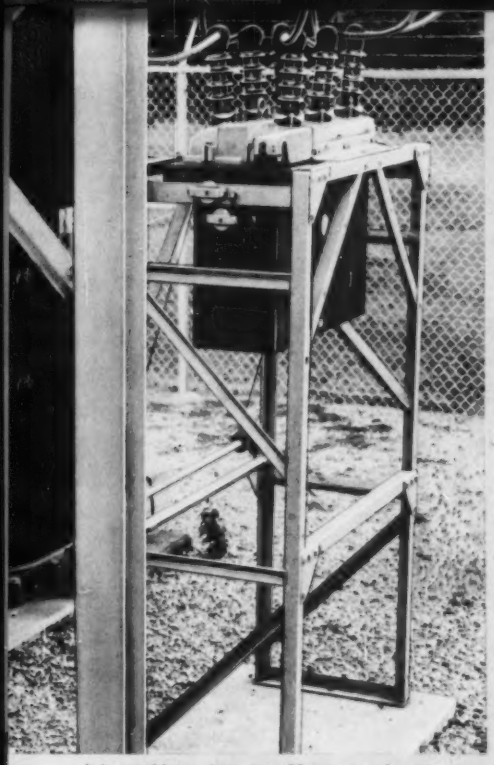
Fewer Outages

L-M Kyle reclosers can also be justified as a fault-protective device that will reduce the number of outages caused by transient or non-persistent causes. Kyle reclosers have extremely fast opening characteristics, clearing circuit in less than 2 cycles, which minimizes conductor burndown and increases service continuity.

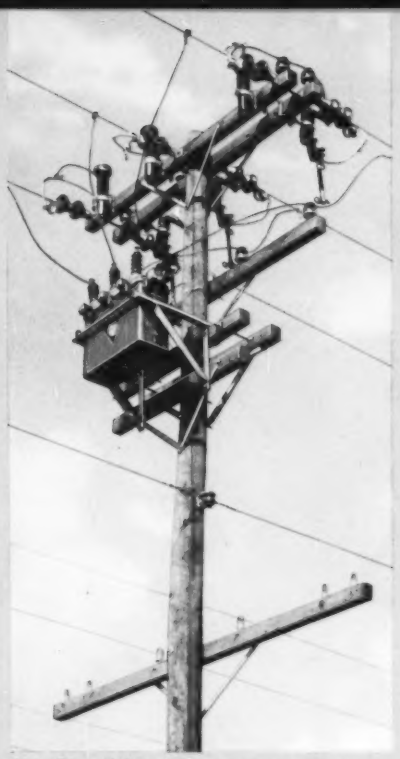
Compare the figures at the left with your construction and operating costs and see how you can save over a half million dollars with Kyle reclosers.

LINE MATERIAL

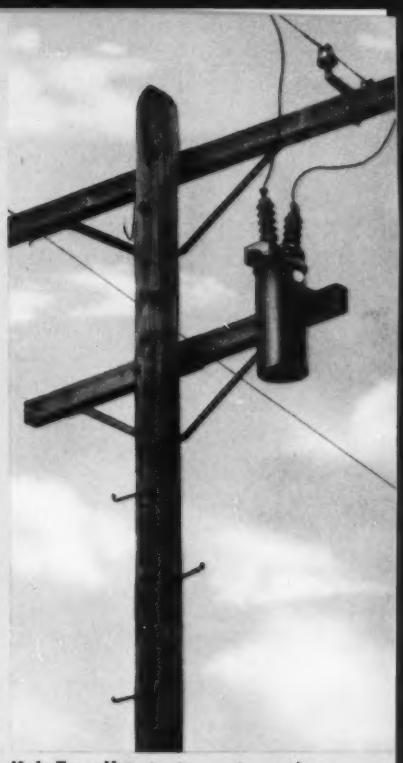
A McGRAW ELECTRIC COMPANY DIVISION



It is possible to clear over 90 percent of total circuit faults and reduce permanent faults with high-speed Kyle reclosers.



Kyle Type 3H 3-phase reclosers provide coordinated protection on rural lines with up to 1250 amperes at 14.4 kv. Where faults persist, recloser locks open on all 3 phases and confines trouble to a small area.



Kyle Type H single-phase recloser reduces the number of outages on rural lines caused by conductors whipping together on long spans, small branches grounding a conductor, or a lightning discharge.

Kyle Reclosers Reduce Investment And System Operating Costs

L-M high-speed reclosers provide better service continuity and lower operating costs by reducing conductor burndown caused by transient or non-persistent faults on the system. It is possible to clear over 90 percent of total circuit faults and reduce permanent faults with high-speed Kyle reclosers. Such faults are often caused by lightning, arrester flashover, tree limbs shorting the conductors, or conductors whipping together on long spans.

Eliminate the Shaded Area

The shaded area in the chart at right represents the additional fault-clearing ability of L-M high-speed Kyle reclosers. Kyle reclosers clear transient or non-persistent faults on the circuit with no significant damage to the system or interruption of service.

All Kyle reclosers can be coordinated in series to provide complete transient protection over entire distribution system.

Get Complete Information

Ask the L-M Field Engineer for more information on how Kyle reclosers can be profitably applied to your system. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

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Kyle® Reclosers

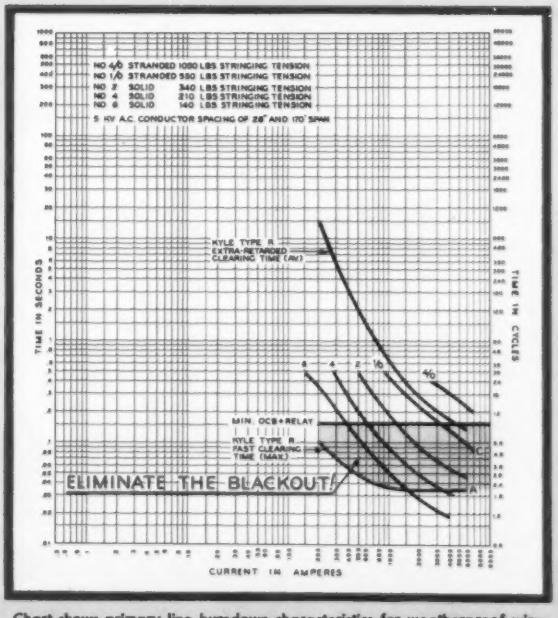
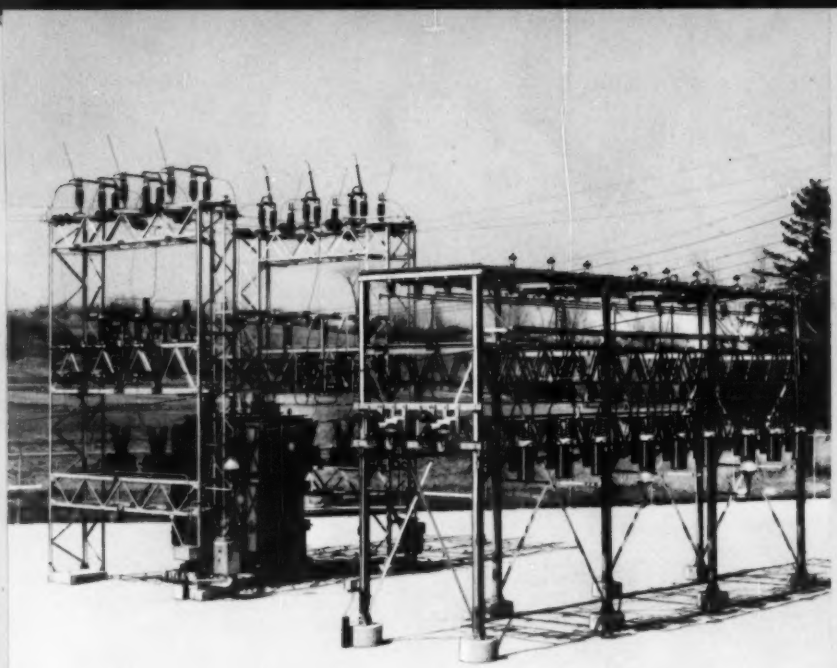
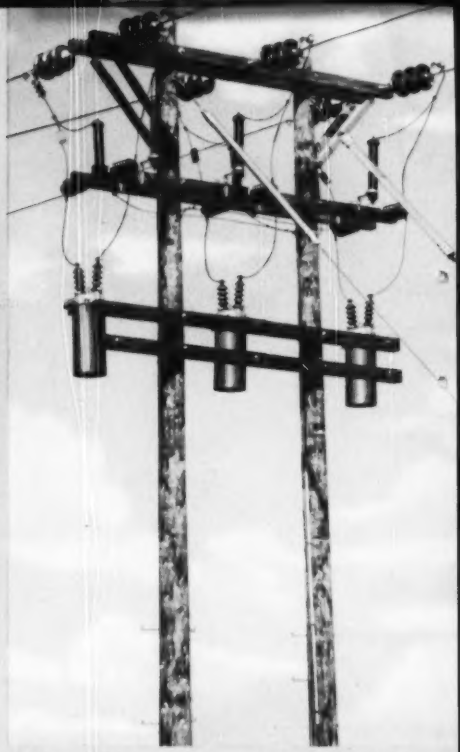

NO 4/0 STRANDED 1050 LBS STRINGING TENSION
NO 1/0 STRANDED 550 LBS STRINGING TENSION
NO 2 SOLID 340 LBS STRINGING TENSION
NO 4 SOLID 210 LBS STRINGING TENSION
NO 6 SOLID 140 LBS STRINGING TENSION
5 KV A.C. CONDUCTOR SPACING OF 28" AND 170' SPAN
KYLE TYPE R EXTRA-RETARDED CLEARING TIME (AV.)
MIN. OCB+RELAY
KYLE TYPE R FAST CLEARING TIME (MAX.)
ELIMINATE THE BLACKOUT!
TIME IN SECONDS
TIME IN CYCLES
CURRENT IN AMPERES

Chart shows primary line burndown characteristics for weatherproof wire. It also gives the maximum clearing time for high-speed Kyle reclosers and minimum clearing time for the average circuit breaker plus relay time. The shaded area represents the additional protection that can be obtained with Kyle reclosers in place of circuit breakers.

more



Nine Kyle Type L heavy-duty, single-phase reclosers are providing high-speed clearing of transient faults and automatic disconnecting of permanent faults with minimum substation investment.



Kyle Type E 23 kv reclosers have large contacts and oil cross-blast method of arc extinction. This makes it outstanding for high-voltage application.

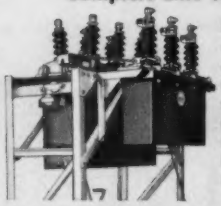
Coordinated Automatic Protection from Substation to Customer's Service

Only Line Material offers a fully coordinated series of single-phase and 3-phase reclosers that will provide complete transient fault protection from substation to load.

Heavy-Duty Type R Recloser

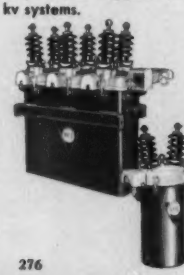
L-M Kyle reclosers are completely self-contained, fully automatic fault-protective devices designed to replace breakers in substations with up to 100,000 kva fault capacity. L-M's heavy-duty Type R 3-phase recloser provides simultaneous tripping of all three phases, with reclosing and dual timing to permit coordination with fuses. This recloser also offers facilities to adapt almost any auxiliary relays and indicating equipment to supplement the normal series overcurrent tripping of the recloser.

Complete Line of Equipment



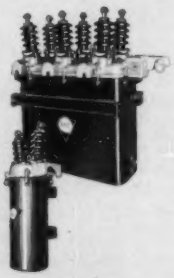
Kyle Type R heavy-duty 3-phase reclosers are available from 25 to 400 amperes, with symmetric interrupting ratings up to 6000 amperes at 4.8 kv and below, and 4000 amperes up to 14.4 kv.

Kyle Type E intermediate-duty single-phase reclosers are available in normal load ratings from 5 to 100 amperes, interrupting ratings up to 1750 symmetric amperes, for applications on 23 kv systems.



Kyle Type H and 3H single-phase and 3-phase reclosers respectively, are available in normal load ratings 5 to 50 amperes, interrupting ratings up to 1250 symmetric amperes, for rural applications on 2.4 to 14.4 kv systems.

Kyle Type L heavy-duty single-phase reclosers are available in normal load ratings from 25 to 280 amperes, interrupting ratings up to 6000 symmetric amperes at 4.8 kv and below and 4000 amperes up to 14.4 kv for substation application, or out on the line.



Kyle Type 4H and 6H intermediate-duty single-phase and 3-phase reclosers respectively, are available in normal load ratings from 5 to 100 amperes interrupting ratings up to 3000 symmetric amperes, 110 kv BIL, for urban applications on 2.4 to 14.4 kv systems.

Get Complete Information

Ask the L-M Field Engineer for more information on how Kyle reclosers can be profitably applied to your system. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

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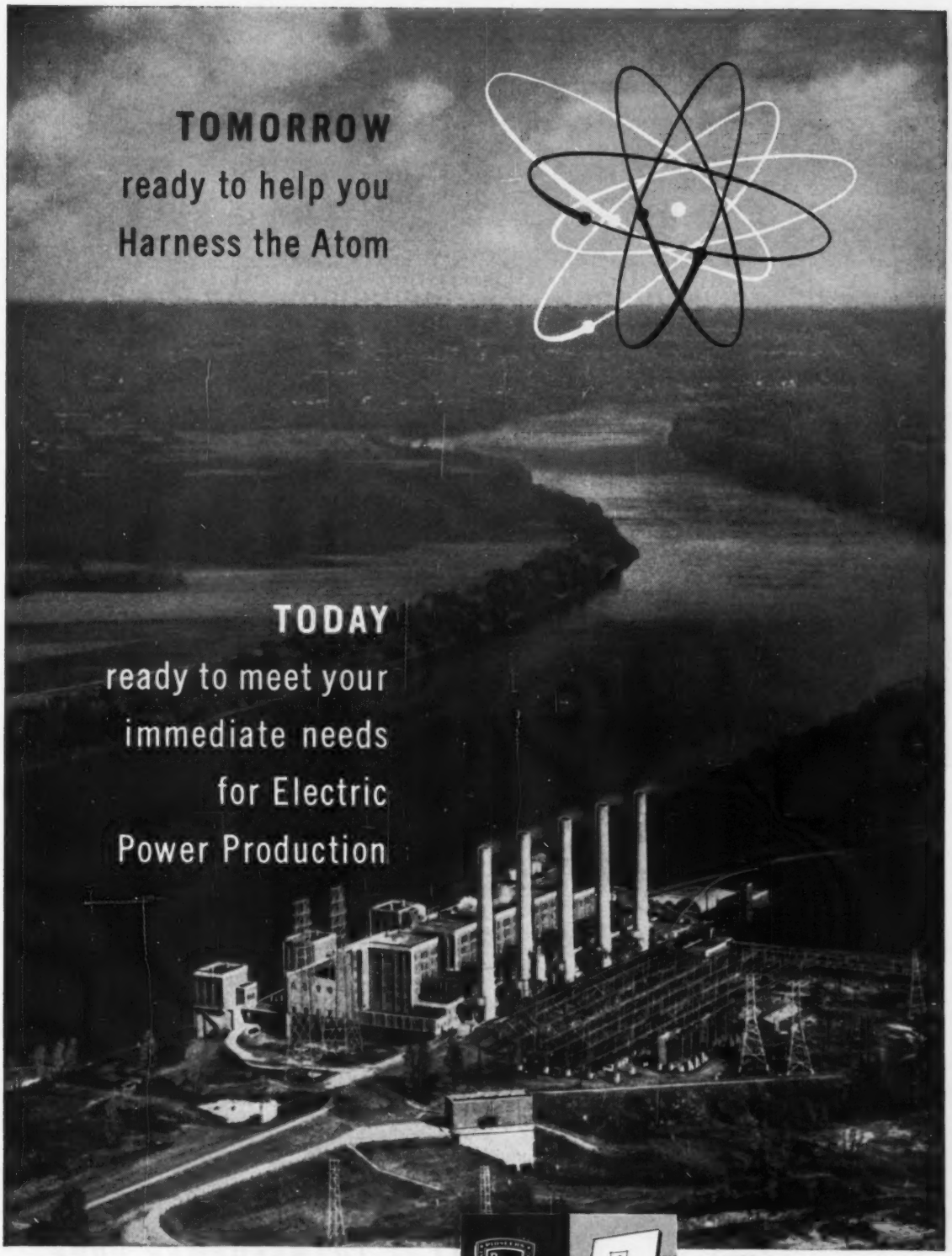
LINE MATERIAL **Kyle® Reclosers**

A McGRAW ELECTRIC COMPANY DIVISION



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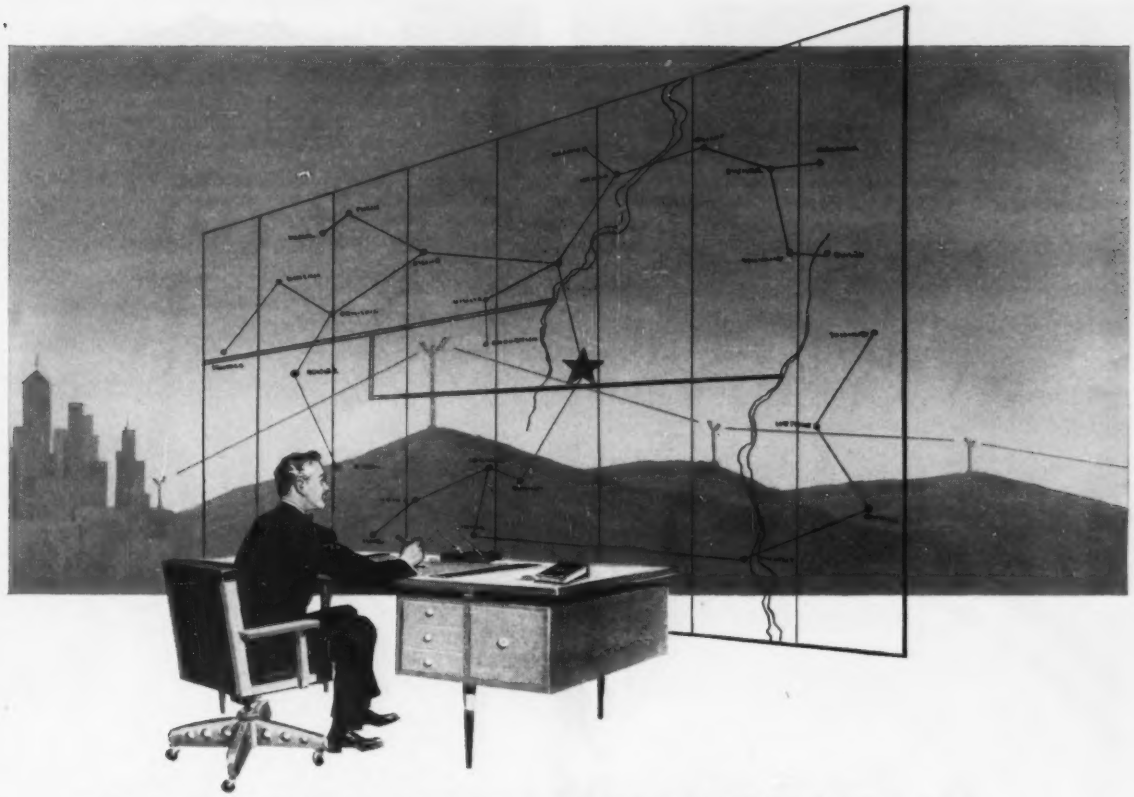

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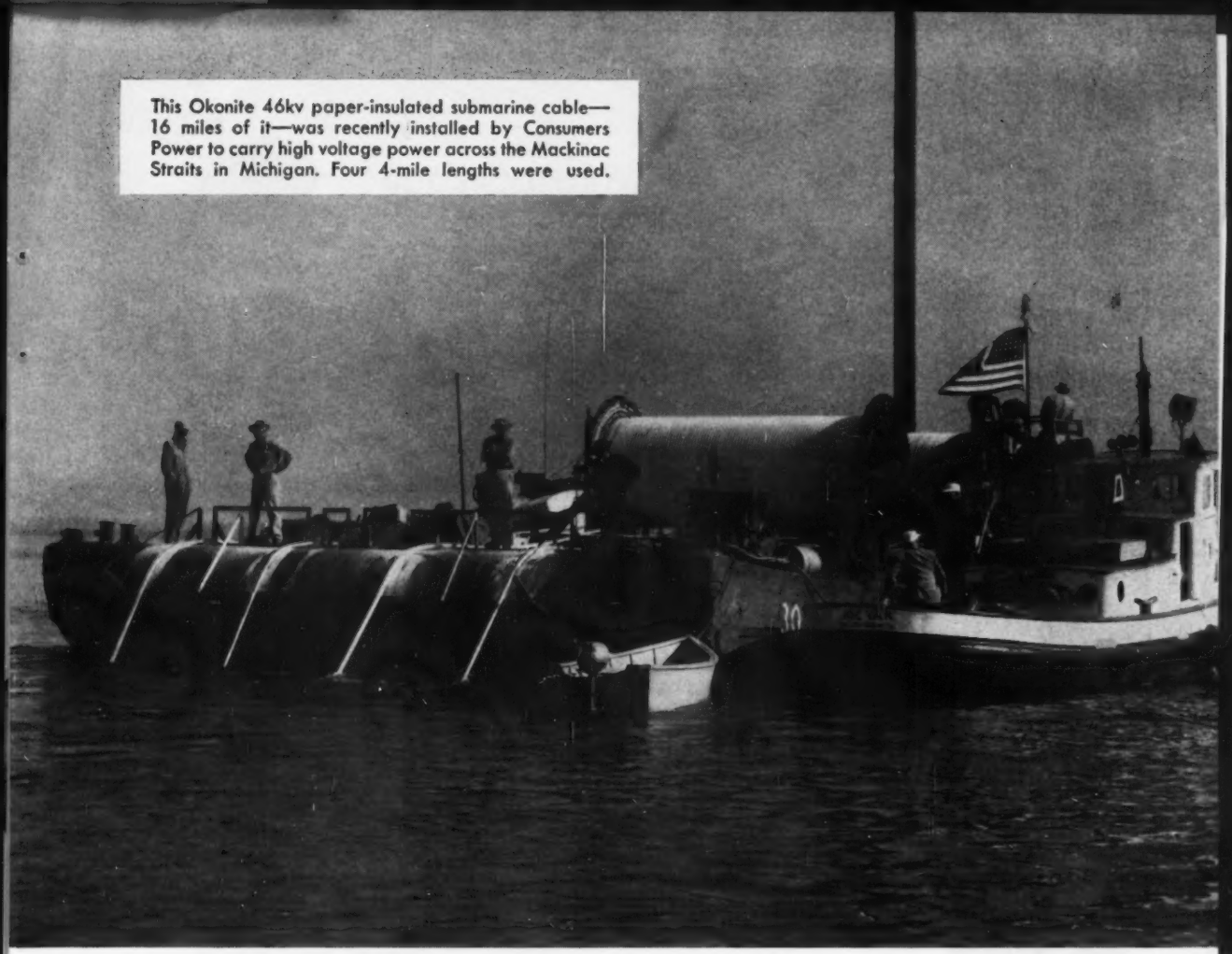
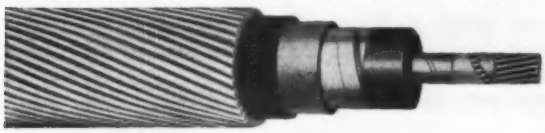


This Okonite 46kv paper-insulated submarine cable—16 miles of it—was recently installed by Consumers Power to carry high voltage power across the Mackinac Straits in Michigan. Four 4-mile lengths were used.

New Consumers Power circuit links upper and lower Michigan for first time

For critical power installations like this one, leading utilities most often place their confidence in Okonite.



Okonite solid type paper-insulated 46 kv submarine cable

Here's why.

With few exceptions, paper-insulated cables are purchased under the basic AEIC specification. But this "spec" does not take into account the experience, the manufacturing methods, or the service records of the manufacturer. And when you buy a cable like the one illustrated above, *these assurances of extra quality are of utmost importance to you.*

Combine these with the carefully researched and tested components of Okonite paper-insulated cables and you have real circuit security. Available with either copper or aluminum conductors, these features are discussed in detail in Bulletin EW-1052. Write for it today. The Okonite Co., Passaic, N. J.

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T&B complete COLOR KEYED splicing package speeds line and service work

Now one new UT 5 installing tool is the *only* tool you need to make all line and service compression connections . . . including splicers, taps, and pin terminals. And T & B's color-keying insures accurate, speedy connections on a wide range of copper, aluminum and A. C. S. R. cable. Here's all you do . . . match the color of the die to the color of the connector . . . compress . . . and the joint is made.

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- Easier, faster to clean and maintain.
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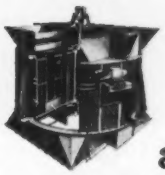

7 out of 10. . . air preheater installations are Ljungstrom®

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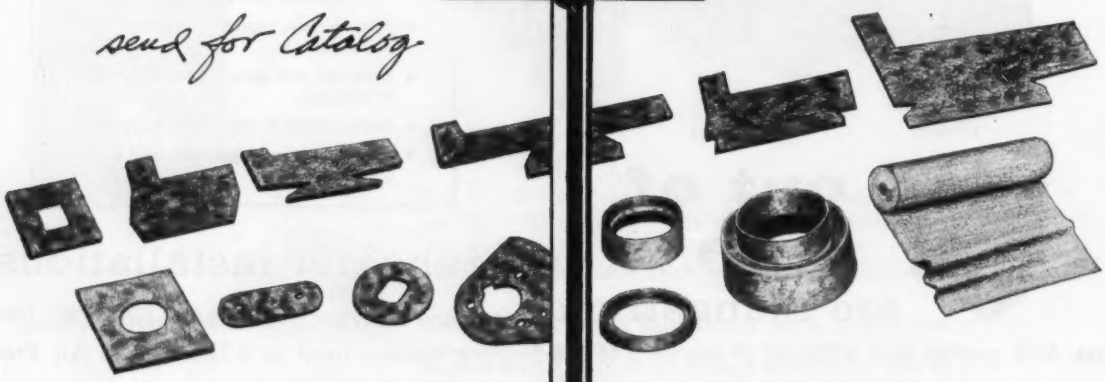

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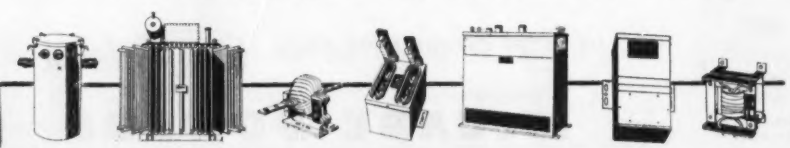

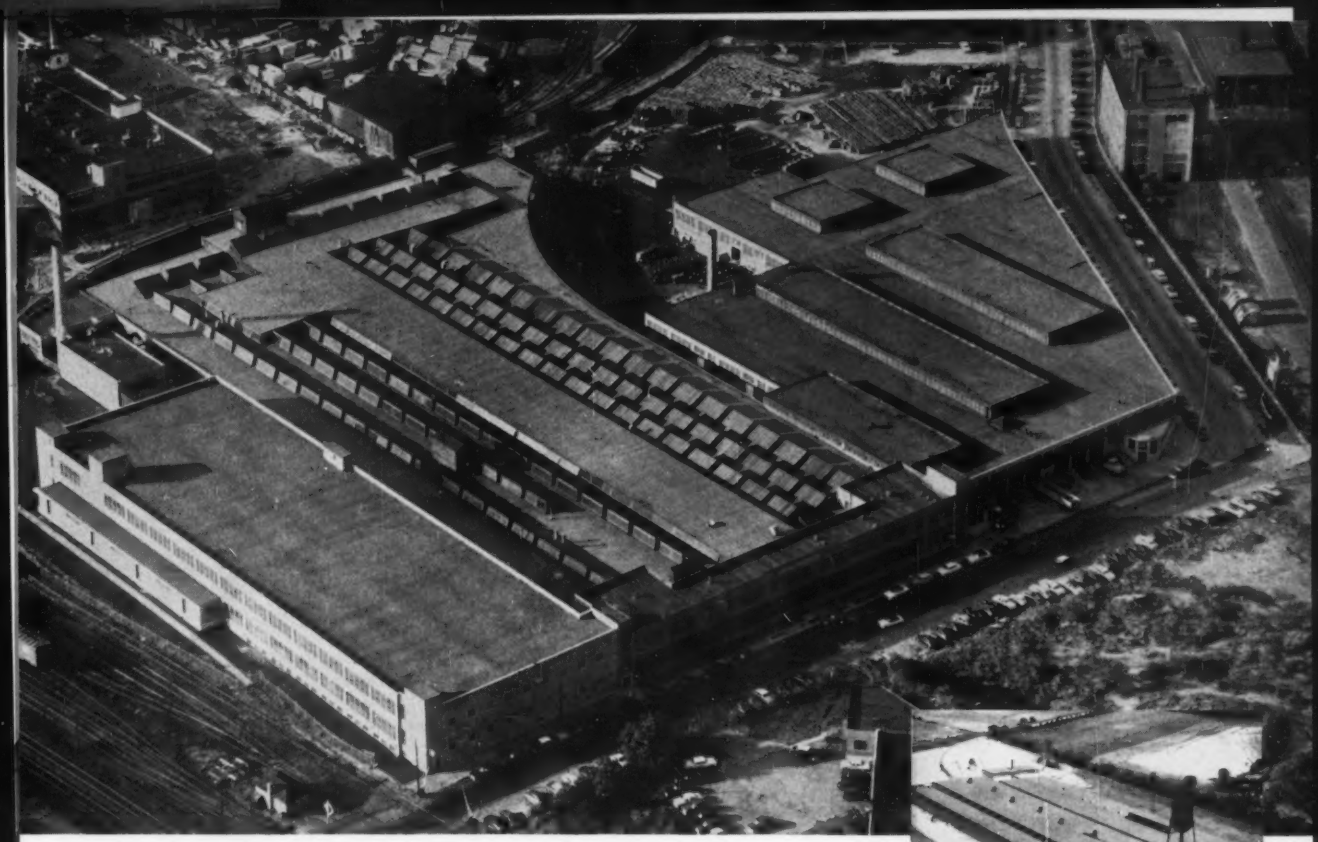

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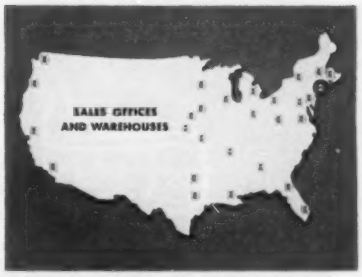

Perhaps the biggest reason why Circle has grown to be one of the country's largest producers of building wire and cable is its record for fast, friendly service. A nationwide network of 22 warehouses supports this policy.

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STRAIGHT LINE CLAMPS

DROP-FORGED from aluminum or steel

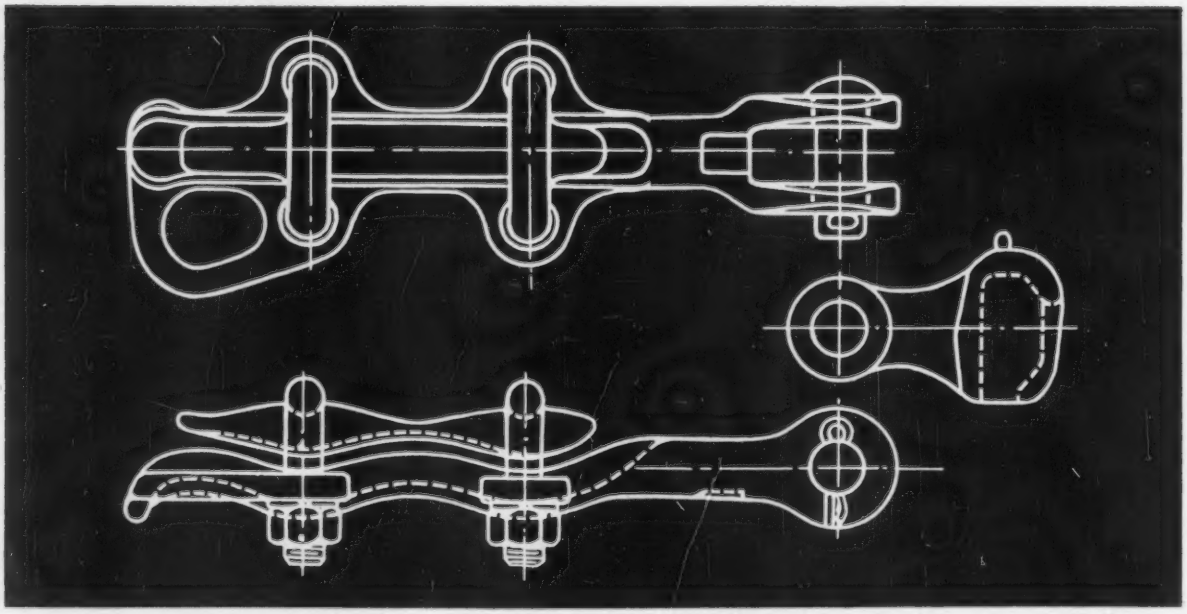
NOW BTC offers a complete series of Drop-Forged Aluminum or Steel Straight Line Clamps, providing an adequate bore size range for the distribution dead end service required of straight line clamps.

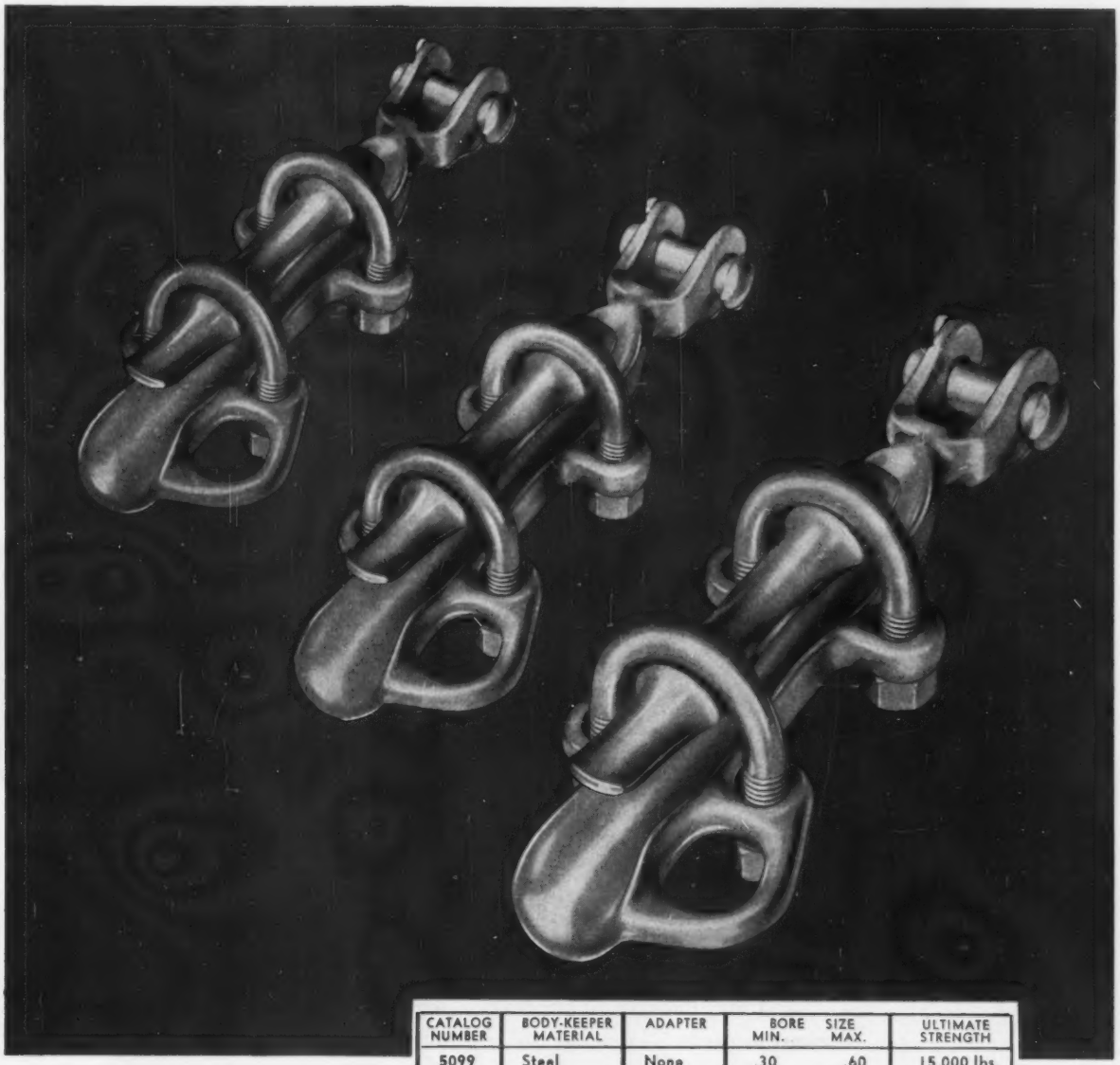
These clamps were developed for distribution, light transmission and sub-station use on all conductors, including Copper, All-Aluminum, 18 x 1 and other A.C.S.R. conductors. Lightweight, amply strong, they follow advanced clamp design.

The corona-free beaded aluminum or steel body of BTC Straight Line Clamps is drop-forged for greater strength. The smooth die-forged wave form cable seat develops adequate slip strengths. Rated ultimate strength is 15,000 lbs. for steel clamps; 12,000 lbs. for aluminum clamps. The loop is of ample size to accommodate come-along hook or shackle. All steel parts are hot-dip galvanized to give longer service.

The point of first conductor-to-clamp contact in BTC Straight Line Clamps is well within the bell-mouthed clamp end. The section of conductor subject to vibration bending is carried over a generous radius and length and is free from clamping pressure which is first applied very lightly, then gradually increased into the high pressure area under the U-Bolts. The design prevents destructive localized concentration of tension and vibration-bending stresses and insures against high clamping pressure damage to conductor at clamp mouth.

The assembly can be supplied with a drop-forged Socket Adapter. Use of Copper or Aluminum Liners is recommended in the steel clamps.





CATALOG NUMBER	BODY-KEEPER MATERIAL	ADAPTER	BORE SIZE MIN.	BORE SIZE MAX.	ULTIMATE STRENGTH
5099	Steel	None	.30	.60	15,000 lbs.
5147	Steel	Socket	.30	.60	15,000 lbs.
5399	Aluminum	None	.30	.60	12,000 lbs.
5447	Aluminum	Socket	.30	.60	12,000 lbs.
5100	Steel	None	.46	.90	15,000 lbs.
5148	Steel	Socket	.46	.90	15,000 lbs.
5400	Aluminum	None	.46	.91	12,000 lbs.
5448	Aluminum	Socket	.46	.91	12,000 lbs.
5101	Steel	None	.65	1.25	15,000 lbs.
5149	Steel	Socket	.65	1.25	15,000 lbs.
5401	Aluminum	None	.65	1.25	12,000 lbs.
5449	Aluminum	Socket	.65	1.25	12,000 lbs.

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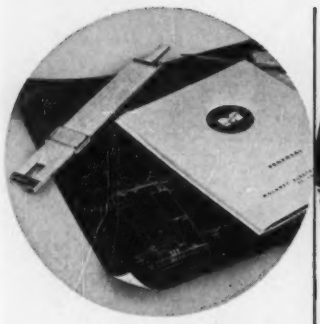
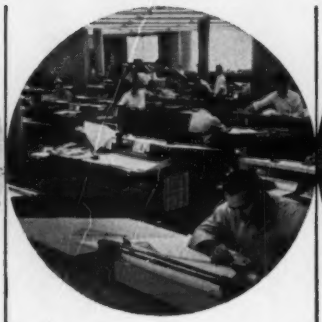
Drop-Forged **BTC** ***Hi-Line Hardware***

THE BREWER-TITCHENER CORPORATION, Cortland, N. Y.

THE PATTERN . . .

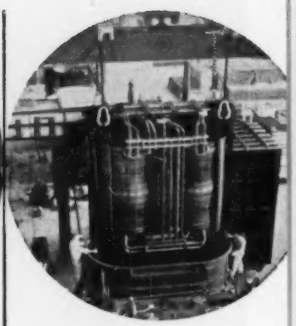


Engineering research augments experience and know-how to make today's product better . . . tomorrow's nearer.



Design experience transfers the thought to plan for product.

Facilities, the finest in the industry, are necessary to produce today's high Kva Moloney Transformers.



Superior production methods assure step-by-step assembly of transformers to meet utility specifications.

True! The only thing you can be sure of is change.

Utility thinking . . . planning . . . needs . . . have changed to meet increasing consumer demands. So, too, it is change at Moloney to keep pace with utility progress. Here, the best transformer today is routine . . . and the best transformer of tomorrow the goal. By research . . . by development . . . and just plain dissatisfaction, we are working to change things for the better.

See us . . . about today's transformer problems . . . tomorrow's . . . or just *because.* Our help is yours . . . just for the asking.

ME56-28

MOLONEY ELECTRIC

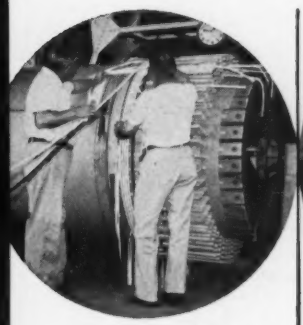
Power Transformers • Distribution Transformers • Load Tap Changing

Step Voltage Regulators • Primary Unit Substations • Secondary Unit Substation Transformers

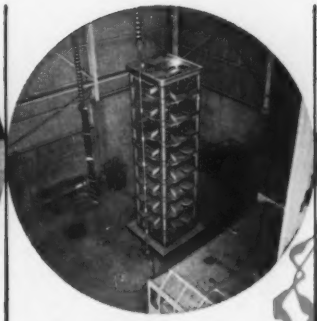
Subway Transformers • Industrial Dry Type Transformers • Capacitors

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS

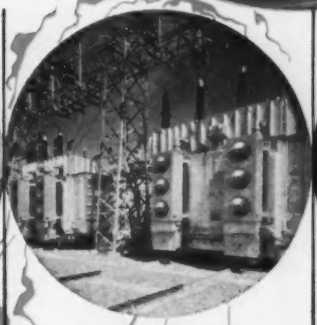
IS CHANGE



Fabrication, by skilled, experienced workmen, transposes engineering and design know-how into product.



Testing, unsurpassed in the industry, pre-proves performance as specified.



Installed and operating . . . as you planned . . . as you specified.

MOLONEY ELECTRIC

The Sign of Quality . . .
All Along the Line.

CO MPANY

Transformers • Regulating Transformers

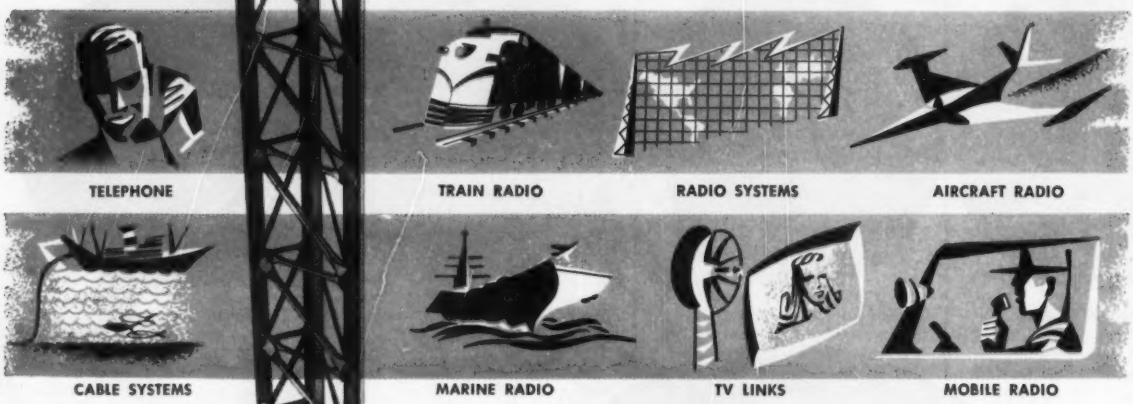
Network Trans- formers • Series Street Lighting Transformers

Transformers and Inductors for Electronics

20, MIS SOURI, AND TORONTO, ONTARIO, CANADA

Behind *Federal* MICROWAVE

—the world's most comprehensive communications experience



Federal, through IT&T's global background in research, engineering, manufacturing and system operation, brings you...
"MICROWAVE AT ITS BEST"

No other microwave system is backed by communications experience so broad and diversified as that of Federal's parent company . . . the world-wide International Telephone and Telegraph Corporation.

IT&T *pioneered* microwave . . . IT&T *knows* communications . . . from the simplest inter-office dial telephone system to intercontinental radio and cable companies serving every corner of the earth. This vast, collective experience, covering system *manufacturing* and system *operation*, is the *plus value* you get *only* with Federal Microwave!

Federal is the system especially designed for pipelines, railroads, utilities, telephone companies, municipalities, highways, TV stations and others . . . meeting every need for high-quality operation of communications, supervisory and control functions.

Whatever your distance, terrain or circuit requirements . . . look to Federal for microwave systems of maximum versatility and dependability . . . built by communications experts . . . and *"Certified by a World of Research."*

WRITE TO DEPT. H-817

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A DIVISION OF
IT&T

Federal Telephone and Radio Company
A Division of
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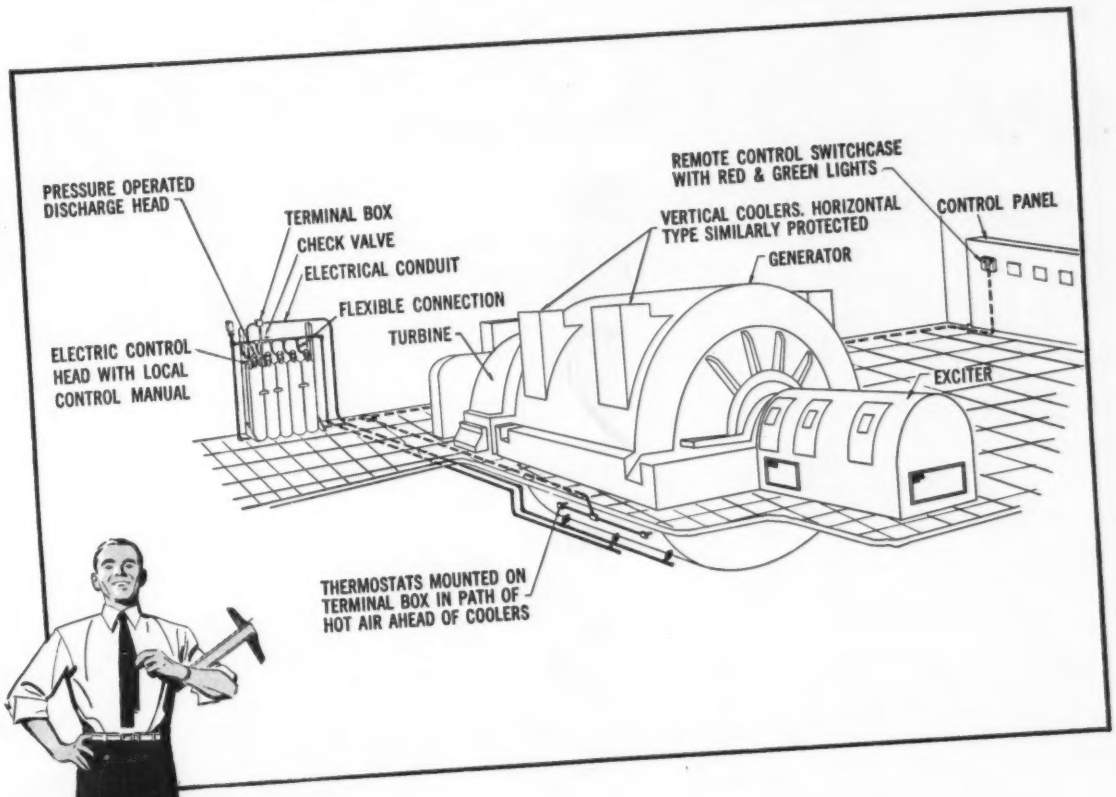


SPECIAL FIRE PROTECTION... TAILOR-MADE FOR GENERATORS!

WHEN an electrical failure strikes a generator you have more than a fire loss on your hands! Besides damage to an expensive piece of equipment, you suffer loss of power output while time consuming repairs are made, to say nothing of valuable transmission equipment lying idle!

Being a *special* kind of fire hazard, generators require *special* fire protection. They should really have *Kidde* fire protection!

Because Kidde fire protection is *fully* automatic, it guards generators 24 hours a day. Thermostats see to it that at the first sign of flame, the system actuates instantly, minimizing damage.

Patented Kidde Multijet nozzles also play an important part in the operation of a Kidde system. Because of their unique design, they insure the most efficient dispersion of carbon dioxide throughout a fire-struck generator's run-down time. And after a fire, the CO_2 used in Kidde systems leaves no mess to harm generators or other valuable electrical equipment. It puts out the blaze, then vanishes into thin air!

Kidde engineers will be pleased to inspect your generators – protected or not – and talk over their recommendations with you free of charge. For more information write to Kidde today.

Kidde

The words 'Kidde', 'Lux', 'Lux-O-Matic', 'Fyre-Freez' and the Kidde seal are trademarks of Walter Kidde & Company, Inc.

Walter Kidde & Company, Inc.
1130 Main Street, Belleville 9, N. J.
Walter Kidde & Company of Canada, Ltd., Montreal—Toronto

the BIG, strong,

You can barely hear these

whispering 4000-hp Allis-Chalmers 2-pole motors

driving boiler-feed pumps at Detroit Edison's River Rouge Plant

Kilowatt output at River Rouge is at a record high — yet things are pretty quiet — especially in the neighborhood of these big 4000-hp, 4000-volt, 3580-rpm Allis-Chalmers motors. Gone is the irritating whine of high speed motor operation — these boiler-feed pump drives just whisper while they work.

Practically all of the mechanical noise has been engineered out by Allis-Chalmers. Special design of the rotor has eliminated much of the noise at its source. This, along with significant modifications in stator design, has resulted in almost unbelievable reductions in sound level. Air inlets have been located away from fans. Noise generated in the motor is now channeled through a lengthy path of acoustically-designed vent passages. Sound-deadening and sound-absorbing materials are used to remove noise before it can be transmitted to the outside.

Other features for dependability and low maintenance

All the advantages that have contributed to the outstanding reliability of Allis-Chalmers 2-pole motors have been retained. In addition, the following new features have been incorporated:

Top Air Intake (available with filter) permits hosing down motor area: motor does not pick up floor dirt.

Top Air Discharge adds to personnel safety and comfort.

Spiral Ventilation provides uniform cooling; aids noise reduction.

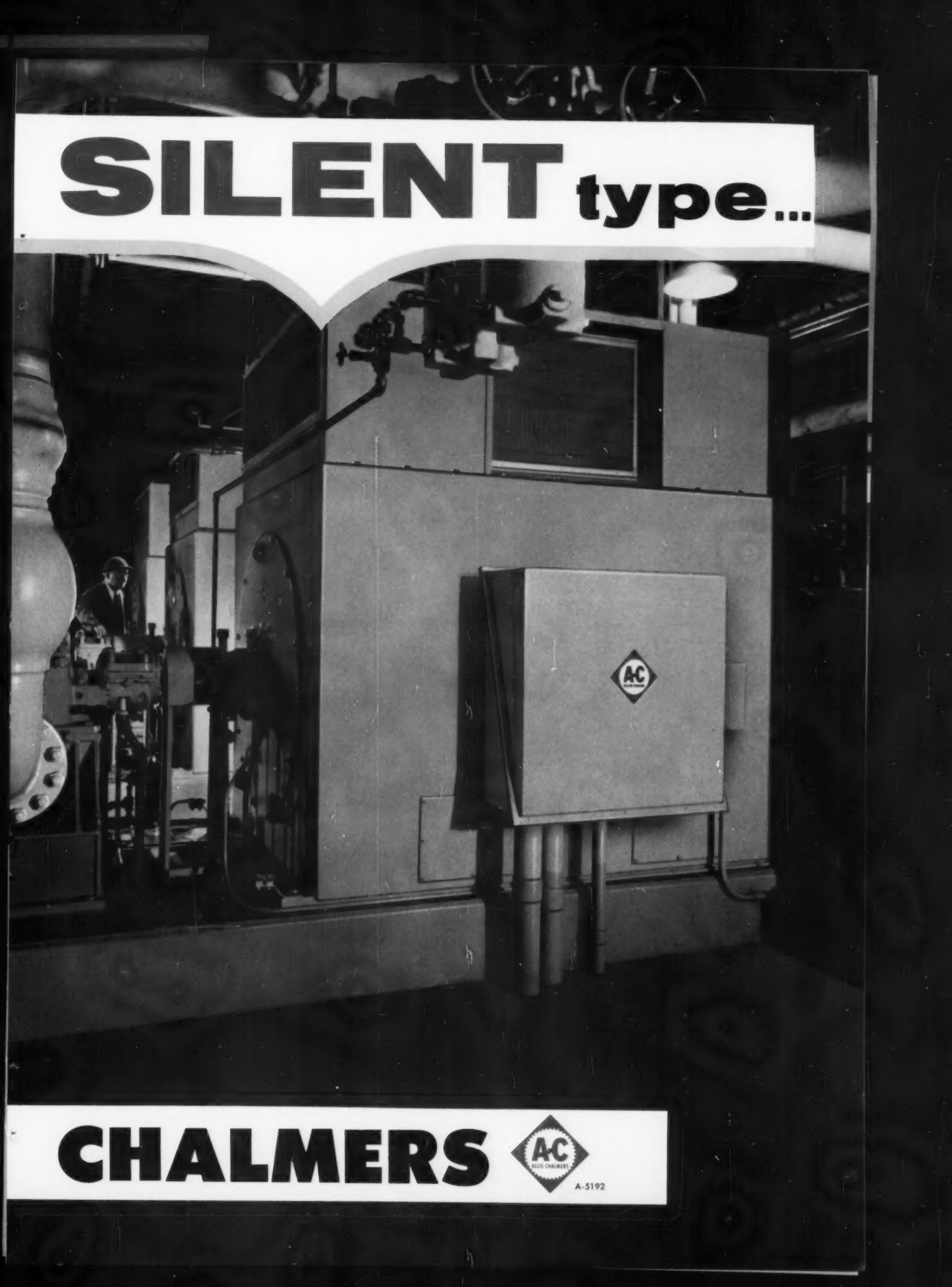
Improved Bearing Design prevents oil leakage, simplifies maintenance. Capsule-type housings permit inspection of windings without exposing bearings.

Sound-Engineered Motors speak for themselves — but softly. Acoustic design, affirmed by continuing user satisfaction, was first proved by test analysis of noise frequency levels on these motors.

- Half octave band frequency analyses showed no objectionable levels at any point on the noise spectrum.
- Test readings remained remarkably low, even at troublesome high frequencies.
- Results showed that conversations next to the motor could be carried on without effort.
- Noise level is so low that these motors would be good neighbors in any powerhouse.

Allis-Chalmers 2-pole motors in this design are available in ratings 900 hp and larger. For complete information, see your A-C representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-


SILENT type...
CHALMERS
A-5192

NOW!

3 new SCOTCHCAST BRAND kits for cable splicing!

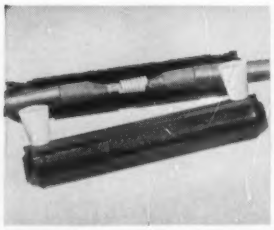
Reg. U.S. Pat. Off.

Here is everything you need to make a splice and insulate it on any single-conductor cable up to 600,000 CM . . . quickly, easily with "factory-tight" efficiency – and it's all in kit form!

The new "SCOTCHCAST" Brand 82-A1, A2 and A3 kits (for different sized straight-line splices) and 90-B1 kit (for wye and tap splices) utilize "SCOTCHCAST" Resin No. 4 in the famous ready-to-use "Unipak" container. "SCOTCHCAST" Resin effectively blocks all possible moisture entry points; gives you maximum insulation and protection against mechanical and electrical stresses on every splice.

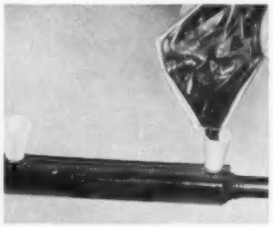
All materials for this revolutionary non-technical splicing method are included in the "SCOTCHCAST" kit. SEND FOR NEW FREE BOOKLET describing the "SCOTCHCAST" kits in detail. Just write on your letterhead to Minnesota Mining and Manufacturing Company, St. Paul 6, Minnesota, Dept. BV-116. Do it today!

Three easy steps...and a completed splice!

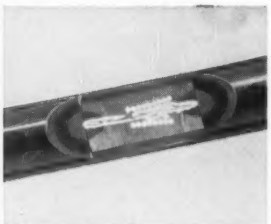


1 Cable is spliced and mold-halves are assembled over splice area. Kit contains all necessary materials.

2 Remove "Unipak" container from foil envelope; squeeze the bag to activate the "SCOTCHCAST" Resin.



3 Pour activated "SCOTCHCAST" into mold, using pouring spouts supplied with kit. Resin begins to set immediately.



4 Cut-away photo shows how tightly splice is sealed – the "SCOTCHCAST" way – against any moisture penetration.

The term "SCOTCHCAST" is a registered trademark of Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. Export Sales Office: 99 Park Ave., New York 16, N.Y. In Canada: P. O. Box 757, London, Ontario.

Two ELLIOTT 5000-hp, 3600-rpm squirrel-cage Induction Motors

Full-load tests confirm the excellent design of

INDUSTRY'S LARGEST 2-POLE INDUCTION MOTORS

The completion of industry's largest two-pole induction motors marks another achievement of the Elliott Company. This is a field in which the Elliott Company has maintained consistent leadership since the first large 2-pole induction motor was built in 1916.

The building of these motors was made possible by extensive previous experience; now the excellence of their design is confirmed by full-load tests. Data obtained in these tests also provide the information needed to insure the success of larger motors yet to come.

The boiler-feed pump motors shown above are the latest Elliott "Super-Quiet" construction, designed to lead the way to lower sound levels demanded by noise-conscious industry today.

Send for a copy of our new booklet, "Milestones," which gives more information about these machines. Address Elliott Company, Ridgway, Pa.

If you have not already seen these motors you are invited to attend the demonstration now being conducted at Ridgway.

ELLIOTT Company

STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS • CONDENSERS
CENTRIFUGAL COMPRESSORS • TURBOCHARGERS • TUBE CLEANERS • STRAINERS

NOW

Southwire Vinyl

"IT'S TOUGH"

weather-resistant

▸LINE WIRE

▸SERVICE DROPS

TRIPLEX — DUPLEX — QUADRUPLEX

To meet the need for a high quality weather-resistant material for line wire and service drops, Southwire proudly presents a new covering—*Southwire Vinyl*—that is competitively priced!

It combines remarkable toughness and resistance to weathering. At the same time it provides a conductor jacket that results in a light, small diameter wire.

Southwire Vinyl has these outstanding qualities:

- **High abrasion and tear resistance**
- **Light, easy to handle; good flexing properties**
- **Free stripping**
- **Excellent resistance to sun; low moisture absorption**
- **High tensile strength and elongation**
- **Wide installation and operation temperature ranges**
- **Resistant to acids, alkalies, oils and greases**
- **Flame resistant; will not support combustion**

Try this new Southwire product with the full assurance that it will meet the severest of tests or applications.

SOUTHWIRE PRODUCTS

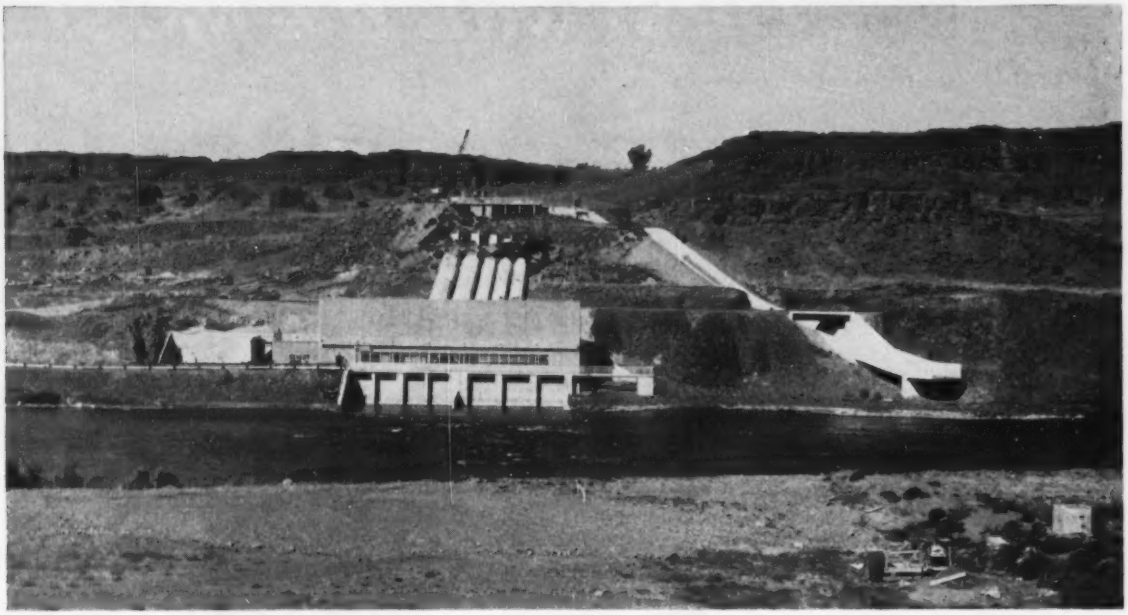
- Bare and Weatherproof Copper and Aluminum Line Wire
- Neoprene Weatherproof Copper, Aluminum and Triplex
- Polyethylene Weatherproof Copper, Aluminum and Triplex
- Southwire Vinyl Weatherproof Copper, Aluminum and Triplex
- Copperweld® Conductors
- Copper and Aluminum Building Wire
- ACSR and All Aluminum Cable
- Steel Guy Strand and Static Wire
- Aluminum Alloy Wire
- Cable Accessories

Southwire means service

Southwire Company

TErrace 2-6311 CARROLLTON, GEORGIA

At the Bureau of Reclamation's Chandler Power & Pumping Plant, Leffel turbines drive both power and pumping units



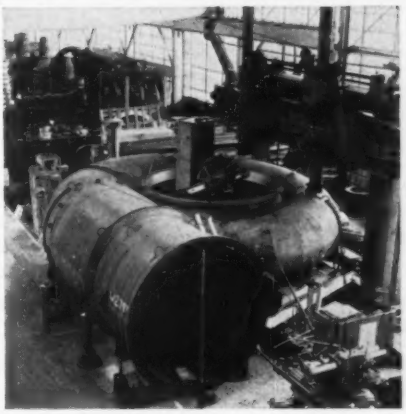
Chandler Power and Pumping Plant seen from the south side of Yakima River.

A principal component of the United States Bureau of Reclamation's Kennewick Division of the Yakima project, the Chandler Power and Pumping Plant is situated near the junction of the Yakima, Snake and Columbia Rivers in south-central Washington.

For economy in construction and efficiency of operation the power and pumping units were combined into one structure. Two Leffel turbines each rated at 8,500 HP under 118 feet net head, speed 240 RPM, drive the generators and two Leffel turbines each rated at 2,600 HP under 118 feet net head, speed 450 RPM, drive the pumps. These turbines are all of the vertical shaft, spiral case Francis type.

When you consider turbines for your power project—whether it is a new installation or the expansion of existing facilities—keep in mind the advantages offered by Leffel . . . 94 years of experience, free engineering assistance, a large modern plant and thorough workmanship.

For a 12-page folder describing all phases of the Chandler Power and Pumping Plant in complete detail and other literature showing Leffel turbines for all hydraulic power requirements fill out and return the coupon below.



One of the spiral casings for the 8,500 HP turbines on Leffel's 24' boring mill.

1098-E

THE JAMES LEFFEL & CO.

FOUNDED IN 1862

MORE EFFICIENT HYDRAULIC POWER FOR 94 YEARS

FREE LITERATURE

THE JAMES LEFFEL & COMPANY
DEPT. P, SPRINGFIELD, OHIO

Please send me 12 page folder on Chandler Power and Pumping Plant and other descriptive literature on Leffel hydraulic turbines.

*Name*_____ *Title*_____

*Company*_____

*Street*_____ *City*_____ *State*_____

Here Now! NEW CHEVROLET FIRST with the MOST

They're out to save you hours and dollars on any hauling job . . . and they've got big new power plus the modern features that make it a sure thing! They put you way ahead with time- and work-saving advantages you won't find in any other truck today!

Year after year—first with the most modern features! And again, for 1957, Chevrolet brings you the industry's most advanced truck features—new developments that have already been proved in a history-making preannouncement test run! (See below.)

For '57 there's bold new styling—rugged good looks to match Chevy's remarkable stamina and dependability. There's new

---

Alcan Highway Test Run Proves Chevrolet Ruggedness!

In an AAA-certified endurance run, 6 new Task-Force trucks roared up the 1,520-mile Alcan Highway (normally a 72-hour run) in less than 45 hours! In dramatic fashion, new Chevy trucks conquered one of the world's most challenging roads and proved their greatness!

A

TASK·FORCE 57 TRUCKS!

modern features

fleet-action power in Chevy's outstanding new engine line-up—with the 195-h.p. Loadmaster V8 standard in all 9000 and 10000 series trucks; and the sensational new 283-cu.-in. Taskmaster V8 (160 h.p.) standard in 5000, 7000 and 8000 series models. All told: *five* high-efficiency V8's and *three* economy-leader 6's in the truck line alone!

Many models are equipped with bigger, brawnier rear axles. And there's a load of heavy-duty options for '57 — including Chevy's revolutionary 6-speed Powermatic transmission, designed especially for heavy-load, high-mileage hauling.

Your Chevy dealer has all the details. When you see him, be sure to check the new cab features, too. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

The "Big Wheel" in trucks!

B

C

A. Cameo Carrier covered entire distance without stopping engine; averaged 18.17 miles per gallon!

B. New Super Taskmaster 283 V8 stole the power show, flattening an obstacle course of mud, gravel and grades!

C. 1,520 miles without shifting gears! Powermatic equipped heavyweight went all the way in a single forward-speed range!

See What Square D's Front-Connected *POWER-STYLE* Switchboards Offer!

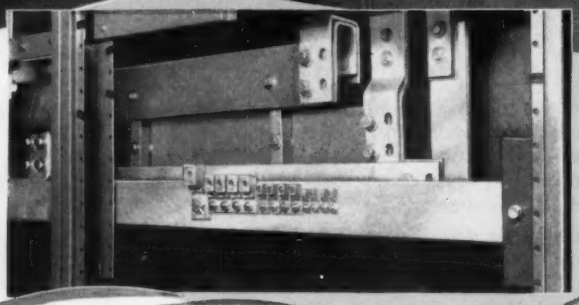
NEW!

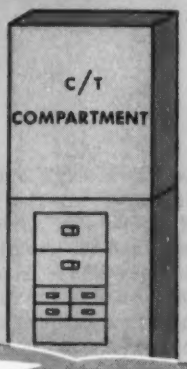
First *completely standardized* switchboard built specifically for small and medium-size installations. Bus bars designed to assure *cool operation in a depth of 14 inches!*

Complete *front accessibility* allows all bus bars and branch circuit connections to be installed and removed *from the front!* Permits mounting directly against wall.

Off-center mounting of breakers (or QMB fusible switches) in right hand section provides maximum room for installing cables from larger units.

Standardized C/T compartment built to meet Edison Electric Institute and Public Utilities' specifications.





Completely standardized horizontal bussing is available up to 2000 amperes, at either top or bottom. Notice bus bar drillings for extension to future sections.

Standardized C/T compartment designed to provide most flexible arrangement. Available in either "hot" or "cold" sequence, top or bottom feed. When used without main disconnect in "hot" sequence, up to six subdivisions can be mounted in same section with C/T compartment.

Write for descriptive bulletin
Address Square D Company, 6060 Rivard Street, Detroit 11, Michigan

SQUARE D COMPANY

STANOLITH Grease gives coal a smooth ride

Over 5,000 bearings need just one grease. Never a bearing lubrication failure.

Part of the coal for the Wabash River Generating Station operated by the Public Service Co. of Indiana near Terre Haute, comes directly from the Viking Coal Mine Processing Plant via a conveyor system. The system operates 365 days a year moving up to 4,800 tons of coal per day. STANOLITH Grease has been used to lubricate all bearings in the conveyor system since February 3, 1953, the start up day. In all that time there has never been a bearing lubrication failure.

Prior to the initial operation of the conveyor system, maintenance supervisors checked with Paul Manning, Standard Oil industrial lubrication specialist, about lubricating the new installation. Paul, they knew, has extensive experience (21 years) in handling lubrication problems of this kind. Working with plant management, Paul recommended STANOLITH Grease No. 42 for the job. STANOLITH Grease has fulfilled maximum expectations.

STANOLITH Grease is a smooth textured grease. It is made from highest quality oil, lithium soap and special additives. It resists water washing and water contamination. STANOLITH Grease works well in exposed, outdoor installations. It will not channel. It is chemically stable. It can be applied easily by hand, gun or pressure system.

Find out more about STANOLITH Grease. Talk to your Standard Oil industrial lubrication specialist. There is one near you in any of the 15 Midwest or Rocky Mountain states. Or write 910 South Michigan Avenue, Chicago 80, Illinois.

***Quick facts about* STANOLITH Grease**

- Water resistant
- High temperature resistant
- Pumpable in grease gun or pressure system
- Mechanically stable

STANDARD

STANDARD OIL COMPANY
(Indiana)

Part of coal conveyor system at Wabash Power Plant, Terre Haute. Entire conveyor is lubricated with one grease —STANOLITH. No bearing failures experienced during the 3½ years conveyor has operated.

"Babe, this here's a ree-tort," explained Paul Bunyan to his faithful Blue Ox. "Fer pressure treatin' wood. Them Baxter folks never dunk it, er spray it, er paint it. They got a real fancy process: They stick the wood inside this ree-tort, lock her up fer 20 hours, and when she comes out she's BAXCO pressure treated—chock full o' presarvatives." The great logger scratched his head with a pine tree. "I dunno how they do it, Babe, but them Baxter boys shore treat wood good—they make it last forever." ✻

BAXCO PRESSURE TREATED FOREST PRODUCTS

✻ Not quite *forever*, Paul—but wood, properly pressure treated, does last up to ten times longer. For maximum long-life protection against insects and rot, authorities agree that wood preservatives should be applied by pressure treating—and BAXCO Forest Products are *always* pressure treated. As West Coast pioneers in the wood preserving industry, our experienced engineering staff can assist in supplying you with the right preservative, the proper treatment, for any job. For a prompt quotation—inquire today.

Preservative treatments available: Creosote, Creosote-Petroleum solution, Creosote-Penta solution, Penta, Chemonite, Chromated-Zinc-Chloride, and Protexol fire retardants.

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J. H. BAXTER & CO. *120 Montgomery Street, San Francisco 4, California*

FOR SUPERIOR INSULATION AND JACKETING CHOOSE ALATHON® POLYETHYLENE RESIN

Jacketing of ALATHON®
— for greater durability
— for abrasion resistance
SHIELD
Insulation of ALATHON® for high dielectric strength and heat resistance

The unique properties of ALATHON polyethylene resins make them suitable for both jacketing and insulating applications. Jacketing of black ALATHON withstands conditions of heat, moisture, and weather extremes – assures years of trouble-free service. ALATHON absorbs the shocks of rough handling and thereby speeds installation.

The electrical properties of ALATHON polyethylene resins are excellent. Their low power factor and dielectric constant remain essentially unchanged over a wide range of frequencies and temperatures. Their moisture resistance and lightness of weight make them eminently suitable for insulating applications.

A complete family of ALATHON polyethylene resin compositions is offered by the Du Pont Polychemicals Department. For the compound best suited to your particular use, send for complete details by mailing the coupon below.

There is a difference in polyethylenes—

specify ALATHON®
polyethylene resin

DU PONT
® REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
Polychemicals Department
Room 3511, Du Pont Building, Wilmington 98, Delaware

Please send me complete information on Du Pont "ALATHON" polyethylene resins. I am interested in evaluating these materials for

.....

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*Name*_____ *Position*_____

*Firm Name*_____

*Street Address*_____

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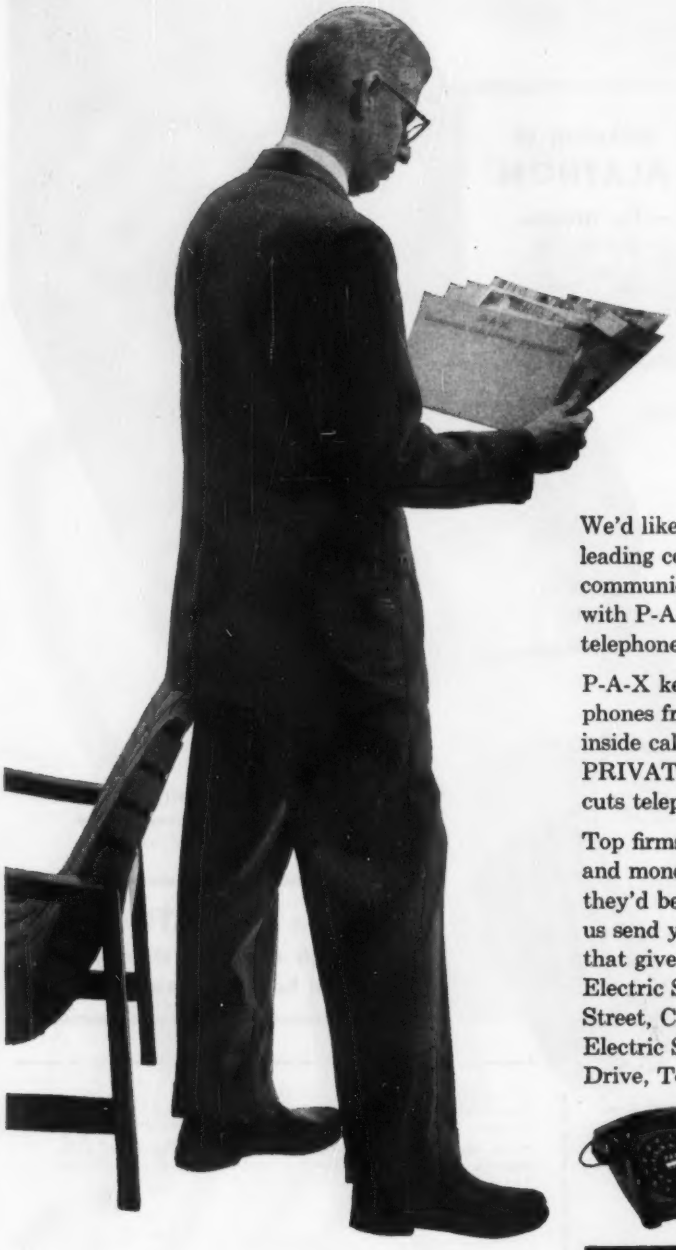
*Type of Business*_____

Swap 60 seconds for an idea that may save your company thousands of dollars?



We'd like to show you how a great many leading companies have improved their communications and pocketed sizable savings with P-A-X—the "inside" business telephone system.

P-A-X keeps your present switchboard and phones free for outside calls. Lets you make inside calls in a flash—OVER YOUR OWN PRIVATE TELEPHONE SYSTEM. Sharply cuts telephone operating costs.

Top firms in all industries save time and money with P-A-X—in fact, they tell us they'd be in a jam without it. See for yourself. Let us send you an interesting Case History File that gives facts and figures. Write: Automatic Electric Sales Corporation, 1033 W. Van Buren Street, Chicago 7, Ill. *In Canada:* Automatic Electric Sales (Canada) Ltd., 185 Bartley Drive, Toronto. *Offices in principal cities.*

P-A-X *business telephone systems*

AUTOMATIC ELECTRIC

Originators of the dial telephone • Pioneers in automatic control

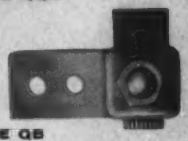
GENERAL TELEPHONE SYSTEM

how's your QA-IQ?

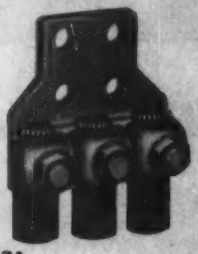
TYPE Q2A

TYPE QA-90

TYPE QQA



TYPE QB



TYPE Q3A

Did you know all of these terminals incorporate all standard Qiklug features?

Popular sizes in stock to meet your individual requirements.

QIKLUG
TYPE QA-B

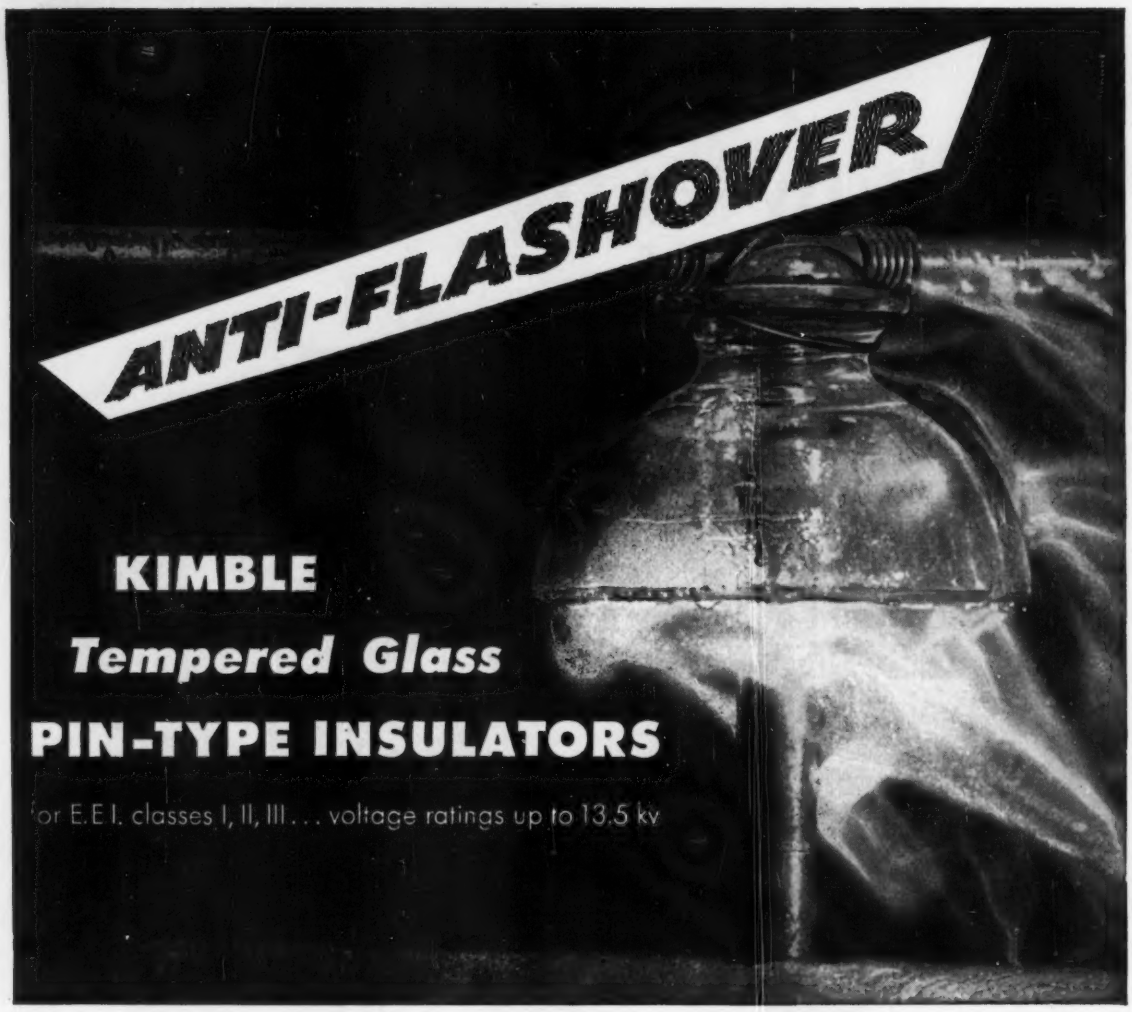
Available for wire sizes #14 thru 2000Mcm.

Get the right answers to all your connector problems.
Write for Burndy Pocket Catalog P-52, filled with facts you'll want in your pocket.

BURNDY

56-1

Norwalk, Connect. • Toronto, Canada • Other Factories: New York, Calif., Toronto • Export: Philips Export Corp.



EXCEEDS CLASS III SPECIFICATIONS

Wet or dry, pick your flashover test, NEW Kimble *Tempered* Glass insulators show flashover resistance exceeding A.I.E.E. requirements. In puncture tests, too, *Tempered* Glass insulators are outstanding. It has proved impossible to puncture them in air, even under the most severe maximum voltage impulses applied. Four years of field testing on more than 500 miles of line have produced no puncture failure. Even lightning surges have failed to damage them.

If it's on the pin, it's in service

In the event of shattering due to severe mechanical shock, insulator disintegrates into many small, non-sharp fragments. Trouble shooters can locate broken insulators—fast.

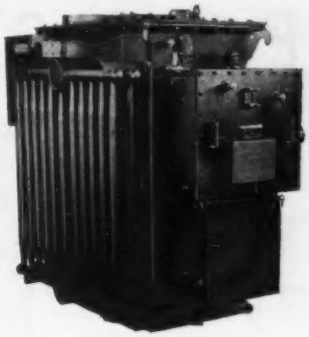
What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. It's a Kimble production method that gives Kimble insulators a hard-compression surface layer that makes them strong enough to meet the severe test required. This great strength saves installation time because it's never necessary to loosen for line up with the conductor—they can always take another quarter-turn.

Why not see how *tempered* glass can cut your line maintenance costs. Write for folder. Address: Kimble Insulator Division, Owens-Illinois, Dpt. EW-11 Box 1035, Toledo 1, Ohio.

KIMBLE INSULATORS
AN (O) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES · TOLEDO 1, OHIO

The engineering design of Uptegraff Distribution Transformers, representing the most advanced practices, assures dependability of this 500 KVA, 34.4 KV unit.



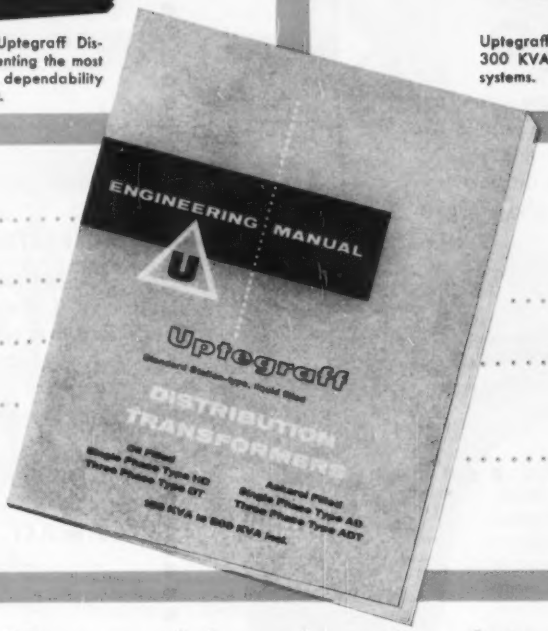
Uptegraff Network Transformer, type NADT, 300 KVA, for urban underground network systems.

ratings ..... efficiencies

dimensions ..... performance data

accessories .....

weights ..... terminal arrangements



New, useful engineering data on Uptegraff Station-Type distribution transformers

May we send you a free copy of the new bulletin illustrated above? It contains detailed specifications and complete data on Uptegraff liquid filled distribution transformers, 150 to 500 KVA inc. The ratings, performance data, dimensions, weights and other information will be found useful in planning new power systems or in extensions and modernization of present equipment. Outline drawings give all critical dimensions for single phase or three phase transformers, oil and askarel immersed. Various terminal arrangements are shown, and terminal dimensions are given in detail.

We will be glad to send you a free copy.

R. E. Uptegraff Manufacturing Co.
Scottdale, Pennsylvania

R. E. UPTEGRAFF MANUFACTURING CO. (EW)
Scottdale, Pennsylvania

Please send a free copy of your New Bulletin describing DISTRIBUTION TRANSFORMERS, Bulletin 136 to:

Name_____

Title_____ Company_____

Address_____

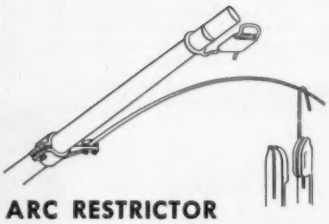
R&IE AIR SWITCHES

now have increased usefulness with the development of

INTERRUPTER ATTACHMENTS

LODRUPTER

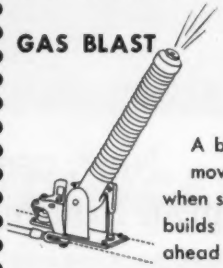
"Arcless" switching of full load current up to 600 amperes. Applies to switches, 7.5 thru 46 Kv., continuous current ratings—400 through 2000 amperes—side or vertical break, or hook-operated. Fused switch combinations also available.



ARC RESTRICTOR

High Speed horns to interrupt line charging current of 15 amps., transformer magnetizing current up to 100,000 Kva. Applies to switches rated up to 138 Kv. Furnished with new switches, or can be attached to already installed switches.

GAS BLAST



A blast of air or nitrogen moving into the path of arc when switch opens (or closes) builds up dielectric strength ahead of restored voltage. Interrupts line charging current or transformer magnetizing current—200 amperes at 34.5 Kv,—to 20 amperes at 330 Kv.

The R&IE scope of interrupting devices has expanded to the area of complete application for definite system switching economies. Complete data and interrupting rating tabulation is available on any of the devices shown. Ask to see the test films or actual operation of any of them.

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PENNSYLVANIA

R&IE

GENERAL CABLE'S HIGH QUALITY CONTROL CABLE with

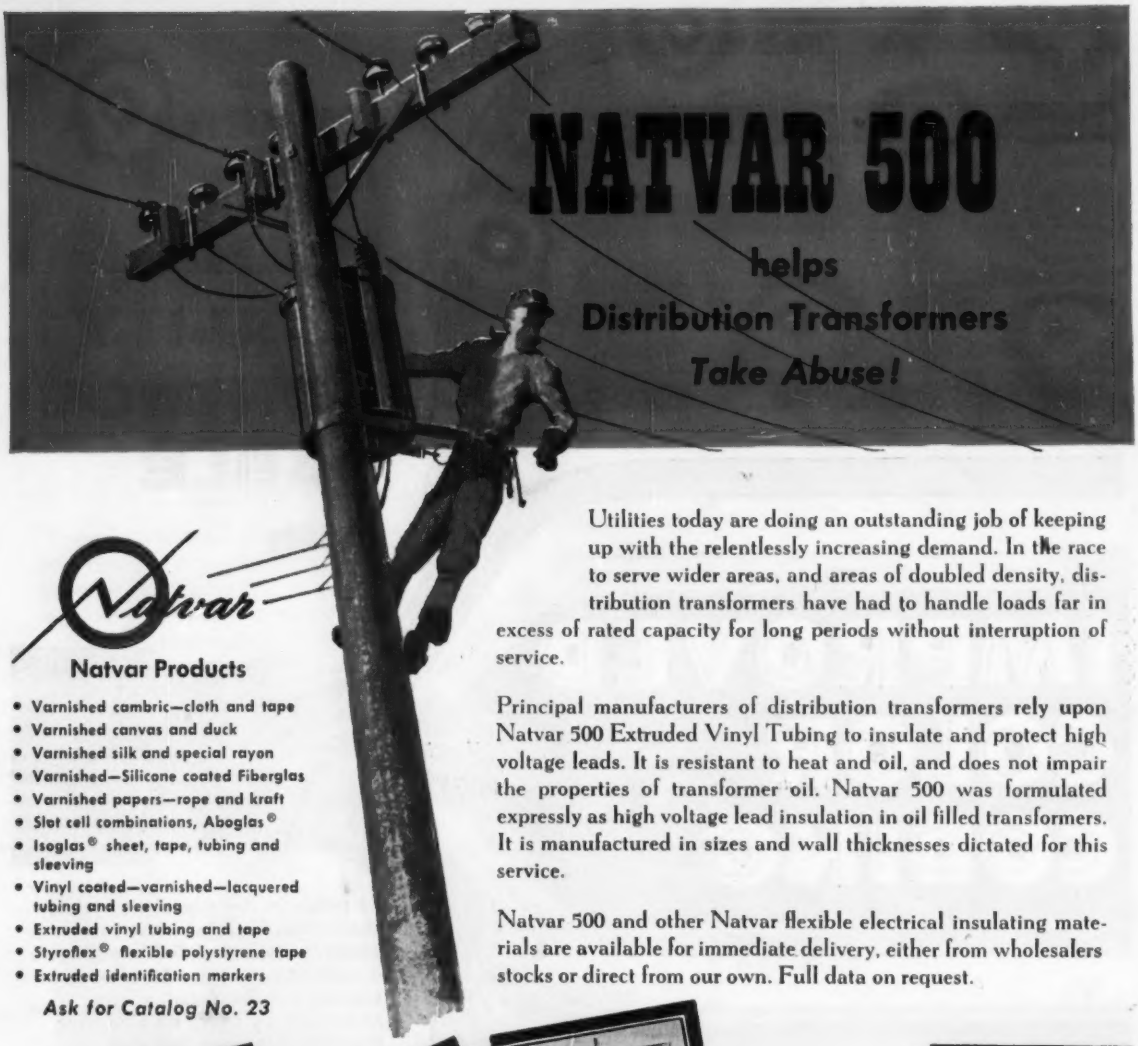
To preserve the superior physical characteristics inherent in black neoprene, General Cable applies a colored synthetic rubber base coating supplemented, where necessary, by spiral striping over the black neoprene jacket of individual conductors.

This new, carefully developed method of color coding the individual conductors of multiple conductor cable results in superior quality, brighter colors and an extra tough coating for permanence.

Station, Traffic, Elevator and Railway control cables are color coded in accordance with IPCEA Standard color sequence and to customer's specifications.

GENERAL CABLE CORPORATION,
420 Lexington Avenue,
New York 17, N. Y.
Offices and Distribution Centers
Coast-to-Coast.

for quality and service . . . **specify GENERAL CABLE**



NATVAR 500

helps Distribution Transformers *Take Abuse!*

Natvar

Natvar Products

- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
- Varnished—Silicone coated Fiberglas
- Varnished papers—rope and kraft
- Slot cell combinations, Aboglas®
- Isoglas® sheet, tape, tubing and sleeving
- Vinyl coated—varnished—lacquered tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

Ask for Catalog No. 23

Utilities today are doing an outstanding job of keeping up with the relentlessly increasing demand. In the race to serve wider areas, and areas of doubled density, distribution transformers have had to handle loads far in excess of rated capacity for long periods without interruption of service.

Principal manufacturers of distribution transformers rely upon Natvar 500 Extruded Vinyl Tubing to insulate and protect high voltage leads. It is resistant to heat and oil, and does not impair the properties of transformer oil. Natvar 500 was formulated expressly as high voltage lead insulation in oil filled transformers. It is manufactured in sizes and wall thicknesses dictated for this service.

Natvar 500 and other Natvar flexible electrical insulating materials are available for immediate delivery, either from wholesalers stocks or direct from our own. Full data on request.

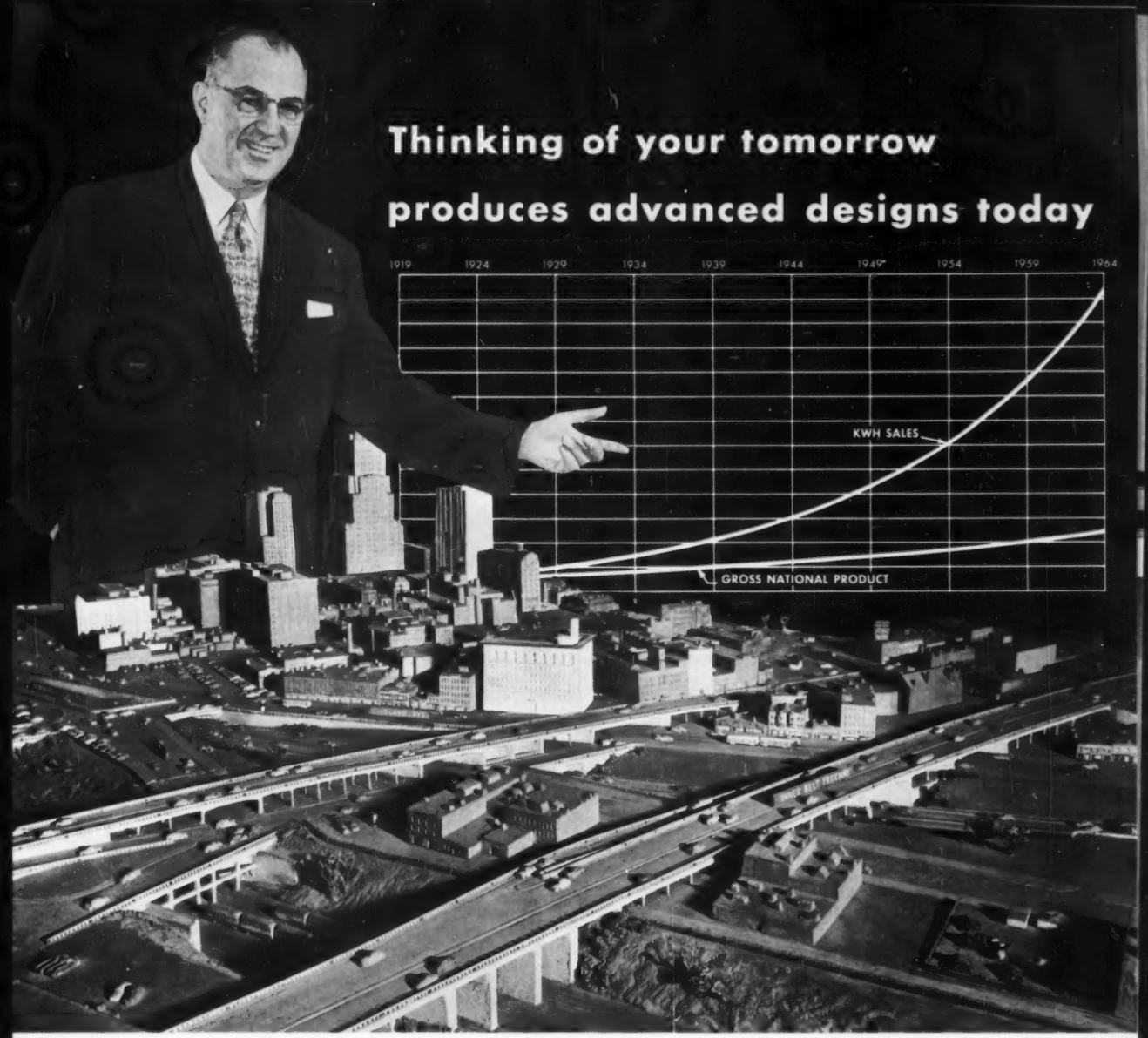
NATVAR CORPORATION

FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

TELEPHONE FULTON 8-8800

CABLE ADDRESS NATVAR: RAHWAY, N. J.

221 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY

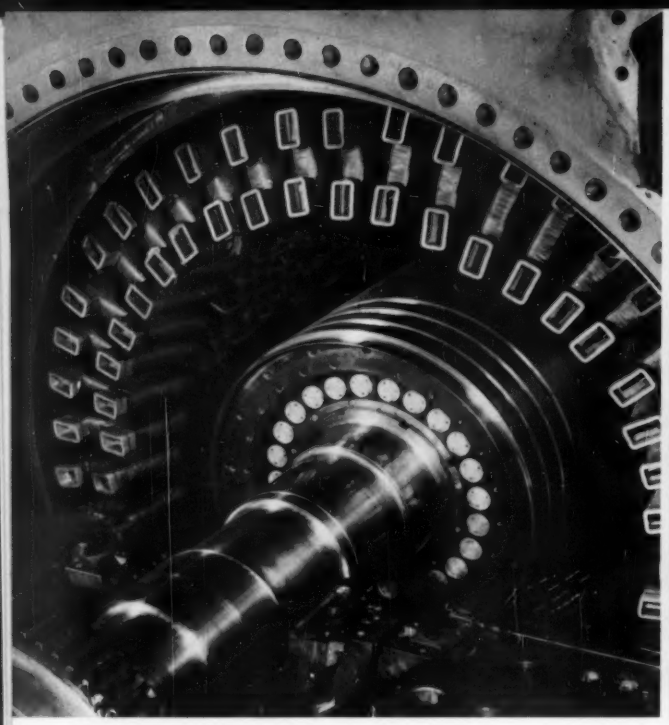


A. C. Monteith, Vice President Apparatus Products, presents some of the Westinghouse achievements in apparatus design . . . features that will help you with your load growth problems.

For a quick look at some of these Westinghouse product developments, see the next three pages.

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU**!*

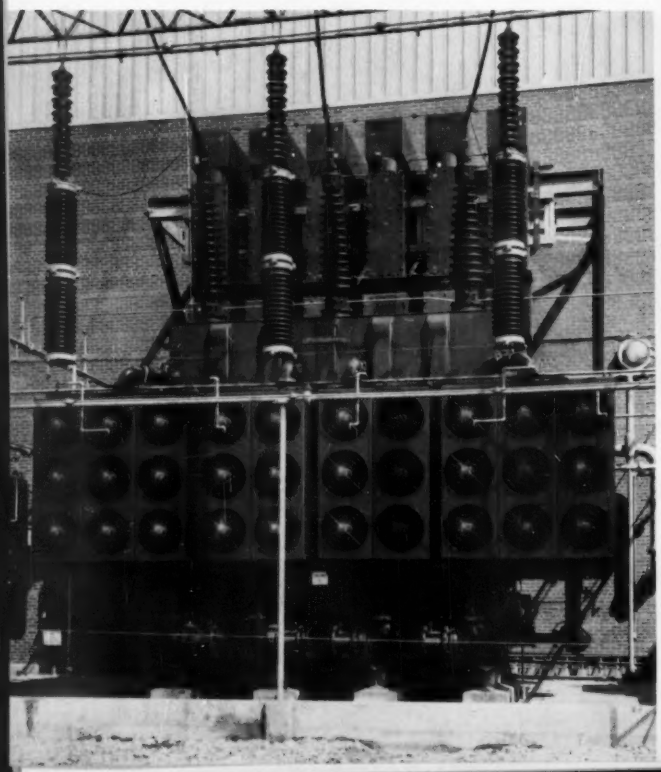


Innercooling Both Stator and Rotor, a Westinghouse first, has made it possible to double generator ratings compared with conventionally cooled units, reducing size, weight.

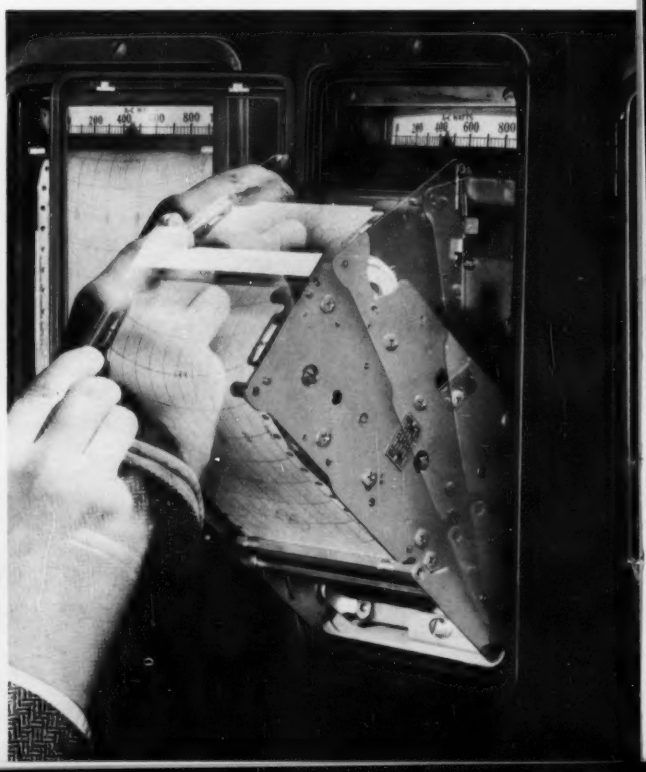
Higher Mechanical Efficiency, up to 92%, is achieved by airfoil blading . . . exclusive in Westinghouse-Sturtevant® centrifugal blowers, the most efficient fans available.

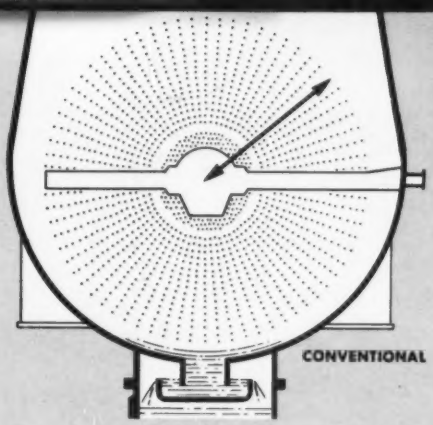
WATCH WESTINGHOUSE

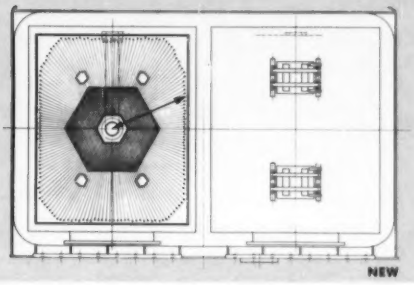
At 315,000 Kva, Largest Capacity 3-phase generator transformer ever built; smaller, lighter per kva than any other transformer. Shipped upright; on-line at Detroit Edison Co.



Twice the Torque of other designs; gives the new Westinghouse Type 44 Recorder faster response, higher fidelity. Accessibility of parts makes it the most convenient to use.







Occupies Less Space while maintaining performance; a dramatic advantage of the exclusive new Twin Bank Condenser, accomplished by dividing steam flow into two paths.

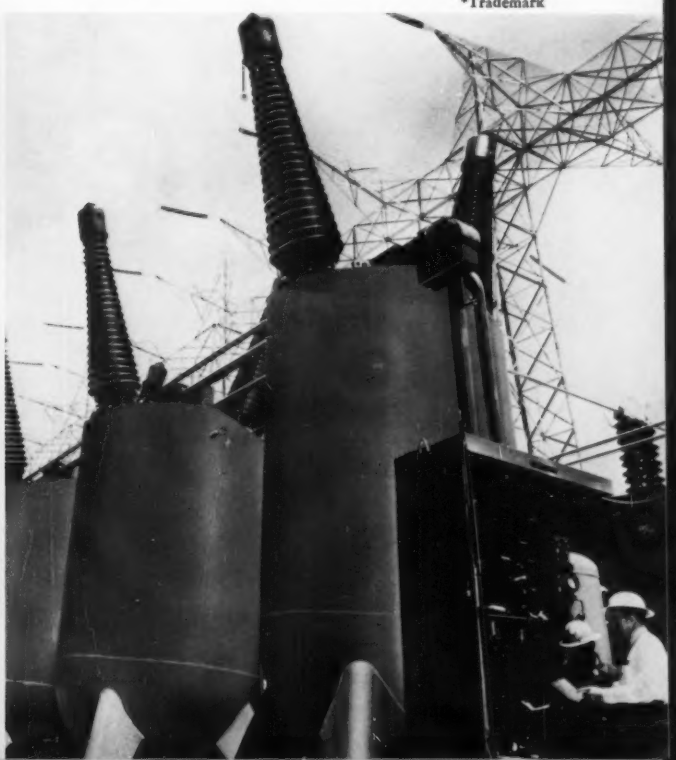
Annual Savings of $50,000 per thousand megawatts can be realized with the revolutionary new Economic Dispatch Computer, recently developed by Westinghouse.

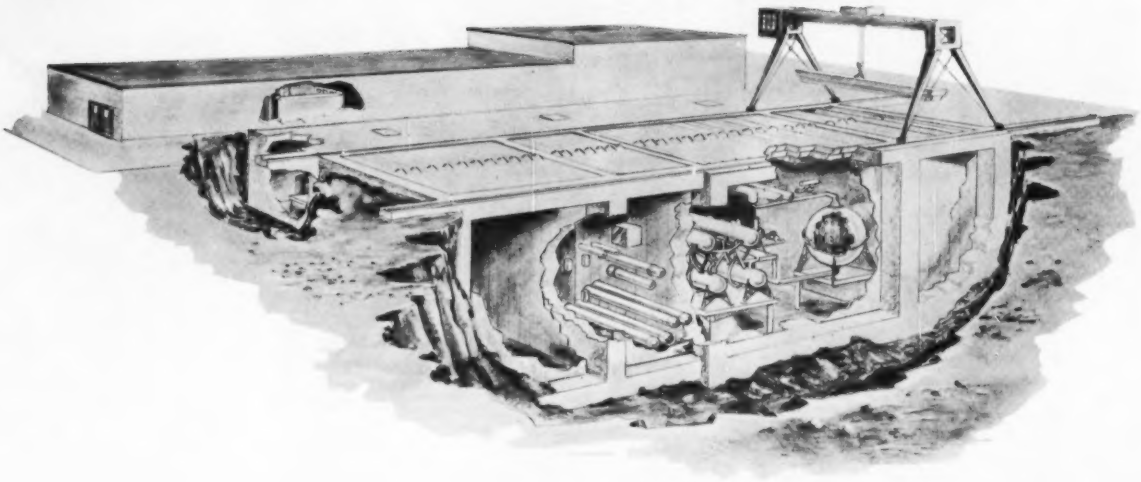
*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***

Wrapped-in Dependability for powerhouse motors. That's Westinghouse Thermalastic® insulation, exclusive and still unequaled where moisture, dust and heat are problems.

World's Largest Breaker, rated 330-kv, 25,000,000-kva interrupting capacity. A Westinghouse development made possible by "Watchcase*" design, "De-ion®" grid interrupters.

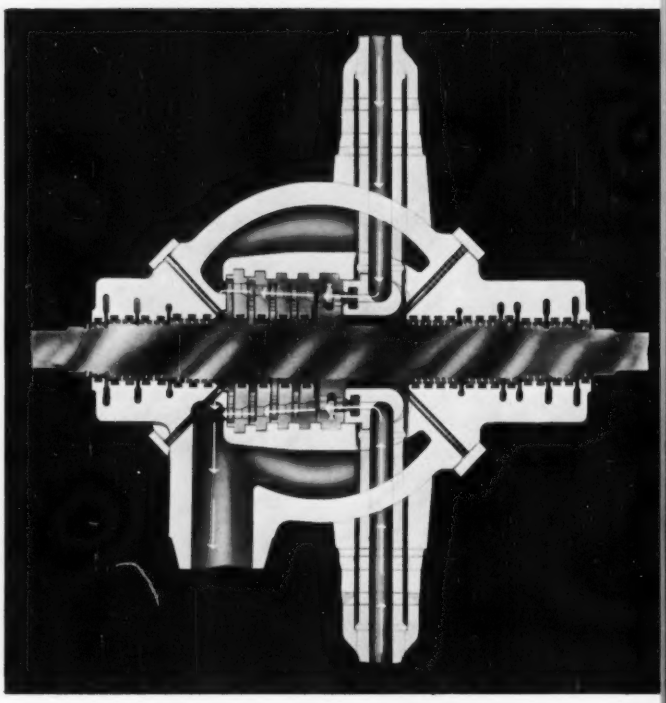
*Trademark





First in Atomic Power, Westinghouse is now pushing forward the development of a very promising aqueous homogeneous nuclear power reactor design, in partnership with the Pennsylvania Power and Light Company.

World's Most Efficient Kilowatt Producer—New supercritical pressure turbine-generator greatly reduces fuel consumption; 5000 psi, 1200°F are highest pressure and temperature ever applied commercially.



The panorama of product development shown here is just a glimpse of creative engineering at Westinghouse . . . and what it is doing for you. New concepts of power generation are inspiring new standards of apparatus capability—higher capacity, greater durability and efficiency, new sources of power. Prime objective: to help utilities meet the fantastic growth projected for the next 20 years.

For specific assistance, get in touch with your Westinghouse sales engineer, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. CP-1038

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***

Wire Sculpture by Henry Szafarz

It's Another World . . .

one in which the forces of nature are extremely rough on man-made things. Thus, the simple fact that Simplex supplies more submarine cable than all other manufacturers combined speaks volumes as to product quality. Simplex Submarine Cables are specifically engineered for reliable underwater communication and power transmission. Their many varieties of outer coverings, wire armor, heavy jackets of Neoprene and other materials, guard against underwater hazards and assure long, dependable service.

SIMPLEX WIRE & CABLE CO.,
79 Sidney Street,
Cambridge 39, Mass.

Photo of Transoceanic Telephone Cable, Cut Back to Show Construction

LIVE BETTER ELECTRICALLY

Simplex

"I'll be right down, Joe... These PLP DEAD-ENDS are a cinch to install"...

Installation of a PLP Dead-End is no trick at all. It's fast and it's done right the first time, by hand. No need to recheck later.

The resulting installation is neat . . . safe . . . permanent.

The streamlined appearance speaks for itself. Safety is assured because there are no sharp edges, no concentrated stress or fatigue point.

A speedy installation, and trouble-free service are reasons why linemen prefer PLP Service Entrance Dead-Ends. Call a PLP Representative today, ask for a demonstration.

PX-76

Made in accordance with or for use under U. S. Patent No. 2,761,273; other patents pending

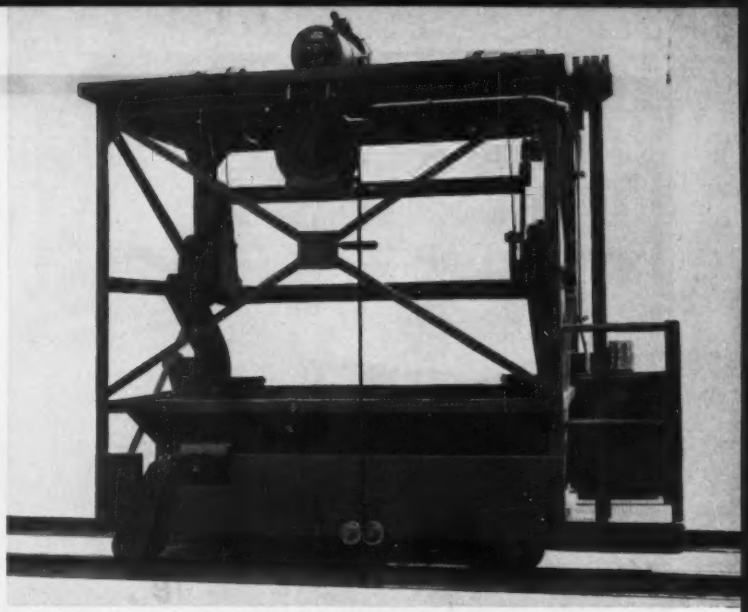
PLP

PREFORMED LINE PRODUCTS COMPANY

5349 St. Clair Avenue — Cleveland 3, Ohio

TELEPHONE: CLEVELAND EXPRESS 1-3571

TRASH RAKE... PACECO STYLE



Rake carrier moves to desired location . . .

. . . Rake drops to desired depth . . . tilts to horizontal position to catch trash . . . raises, and dumps!

This Paceco designed trash rake is now giving efficient, effective service on dams. It is low in first cost and economical and fast in operation.

Paceco specializes in custom-built equipment for electric generating projects. We design and manufacture cranes, hoists, gates, penstocks and allied heavy equipment.

Some units we build direct from the buyer's plans. In many instances, however, Paceco engineers work with the buyer *at the designing stage*. Experience has proved this consultation may sharply lower initial cost, improve operational efficiency and reduce maintenance.

For over 30 years, many of the country's leading utilities have enjoyed Paceco's quality control, engineering skills and price economies – all under *one responsibility*. Your inquiry is requested for preliminary discussion or invitation to bid –

Send for Paceco's illustrated brochure, "Custom Designed Equipment for Hydro-Electric and Steam Power Plants and Water Works."

PACECO

"TAILORS OF STEEL"®

PACIFIC COAST ENGINEERING COMPANY

ENGINEERS • MACHINISTS • FABRICATORS

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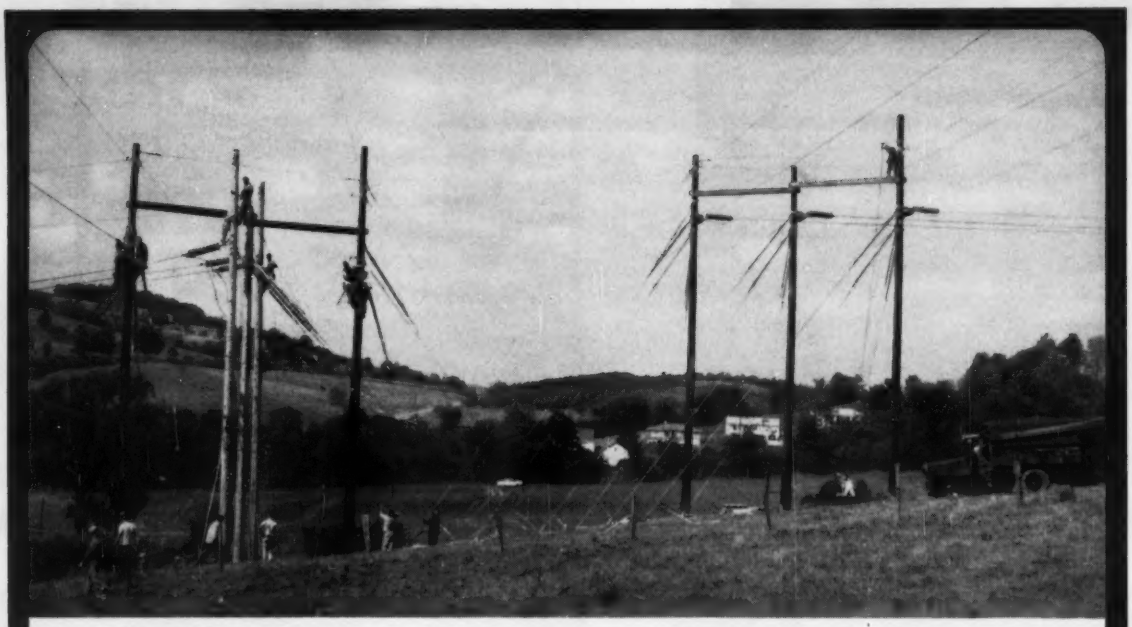


New York State Electric & Gas Corporation has been a consistent user of Penta-treated poles and wood members ever since the preservative against decay and wood-boring insects was first introduced. In this picture, line crews erect two dead-end structures in an existing 115-kv line so it can be looped in and out of a new 50,000-kva, 115/34.5-kv substation at Binghamton.

New York Electric & Gas Corp. uses Penta-treated poles for long life

MR. C. R. GILLETTE, TRANSMISSION ENGINEER FOR THE COMPANY, HAS THIS TO SAY ABOUT PENTA: *"For many years we have been replacing the wood members of transmission line structures which have decayed long before the hardware, conductors and related attachments have reached the end of their natural life. In an attempt to bring the life expectancy of all parts of the structure more closely together, we adopted Penta as the preservative for transmission materials. The dry, clean surface of Penta-treated wood is an additional bonus benefit."*

Penta protection can be measured. Penta is a stable, uniform chemical compound. Increment borings taken from Penta-treated poles can be chemically analyzed to determine the exact amount of Penta in wood.

FOR A FREE COPY of "Penta for Poles and Crossarms," write Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Dept. PI-7, St. Louis 1, Mo.

MONSANTO

Where Creative Chemistry Works Wonders for You

Here's MORE Progress in Switchgear from Allis-Chalmers

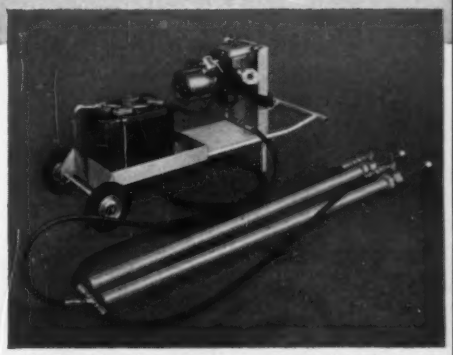
NOW Power-Operated Hydraulic Tank Lifter

Available for Allis-Chalmers intermediate breakers. Another example of Allis-Chalmers progress in simplifying maintenance while increasing safety. Costs no more than hand windlass type, yet cuts raising and lowering time by 80%.

Turning the needle valve completely controls operation and tank may be stopped in any position. Safe even if the hose or fittings are removed during operation.

Pressure energy is obtained from accumulator, power pump or hand pump of *Pneu-Draulic* system.

This is only one of many features of Allis-Chalmers all-new intermediate outdoor oil circuit breakers. Find out more by calling your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



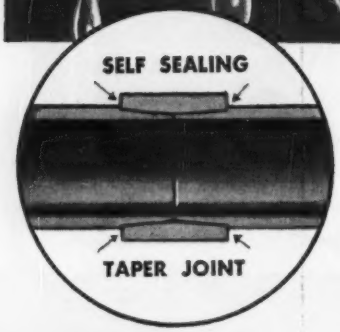
No *Pneu-Draulic* operator on your breaker? Battery operated hydraulic tank lifter is available. Same cylinder and flexible hose. Same operating characteristics.

Pneu-Draulic is an Allis-Chalmers trademark.

ALLIS-CHALMERS

A-5124

WATERTIGHT!



Orangeburg Fibre Conduit Prolongs Cable Life

Keep out corrosive ground waters, and you prolong the life of underground cables, say utility engineers!

Why? Because ground waters containing corrosive elements derived from the soil and concrete encasement attack cable sheath and shorten cable life. Orangeburg's impermeable wall and self-sealing Taper-Sleeve Joint shed them *"like water off a duck's back."* You get maximum protection with Orangeburg.

Orangeburg protects cables in many other ways. Smooth bore, low co-efficient of friction reduce incidence of abrasion. Its material is strong, tough, resilient, durable.

No other conduit is easier to install

Light, 8-foot lengths and a complete line of bends and fittings speed installation. Taper-Sleeve Joints tap water-tight in a jiffy. Orangeburg lays faster and at lower cost than any other type of conduit.

Orangeburg Fibre Conduit has prolonged cable life at minimum expense for utilities, municipalities and industry since 1893.

Distributed by Graybar Electric Company and by General Electric Supply Company. Branches and stocks in principal cities.

WRITE DEPT. EW-116 FOR CAT. 52

ORANGEBURG MANUFACTURING CO., INC., Orangeburg, N. Y. West Coast Plant, Newark, Calif.

ORANGEBURG®
FIBRE CONDUIT

wonder where the BUBBLES went?

Visible voids spot the test pour of an improperly-fluxed heat of aluminum.

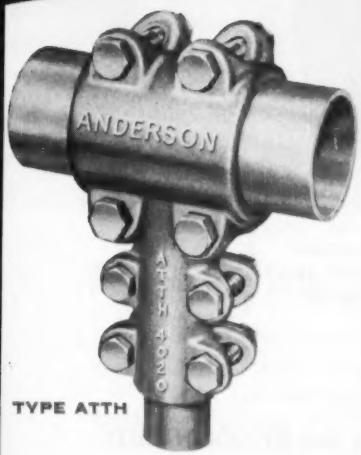
A typical cross-section of sound, bubble-free Anderson Aluminum test pour.

QUALITY CONTROL from the very start removes any chance of "gas porosity" weakness from

ANDERSON

Aluminum

SUBSTATION CONNECTORS



TYPE ATTH

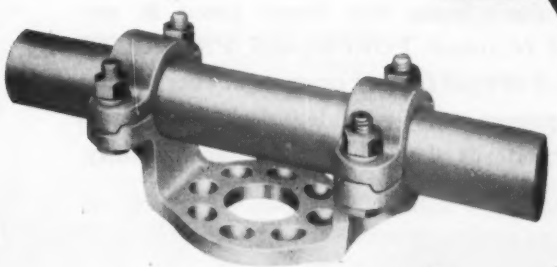
ANDERSON PREDETERMINES LONGER LIFE . . . greater efficiency . . . and higher tensile strength by putting to work the *probing, fact-producing* experiences of 30 years of Aluminum Connector manufacture.

Insuring "high density" by completely eliminating *pin-hole gas porosity* in aluminum castings is just one of Anderson's check-point measures in the production of connectors of outstanding quality. Every heat of aluminum is checked to guarantee that no connector will fail in service because of *voids* in the casting created by *tiny gas bubbles!*

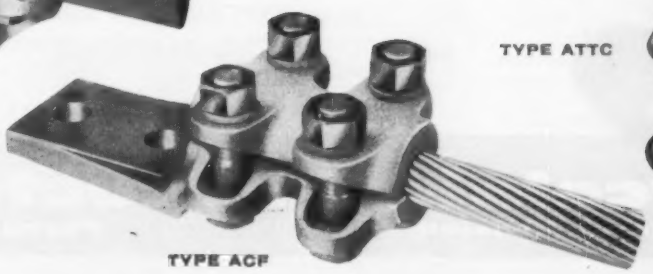
Any Anderson Representative can give you the full, detailed story of our exacting QUALITY CONTROL measures . . . consult your nearest Representative or write to the home office.

Aluminum & Bronze POWER CONNECTORS • CLAMPS • FITTINGS • ACCESSORIES
for SUBSTATION • TRANSMISSION • DISTRIBUTION

ANDERSON ELECTRIC
CORPORATION
BIRMINGHAM 1, ALABAMA



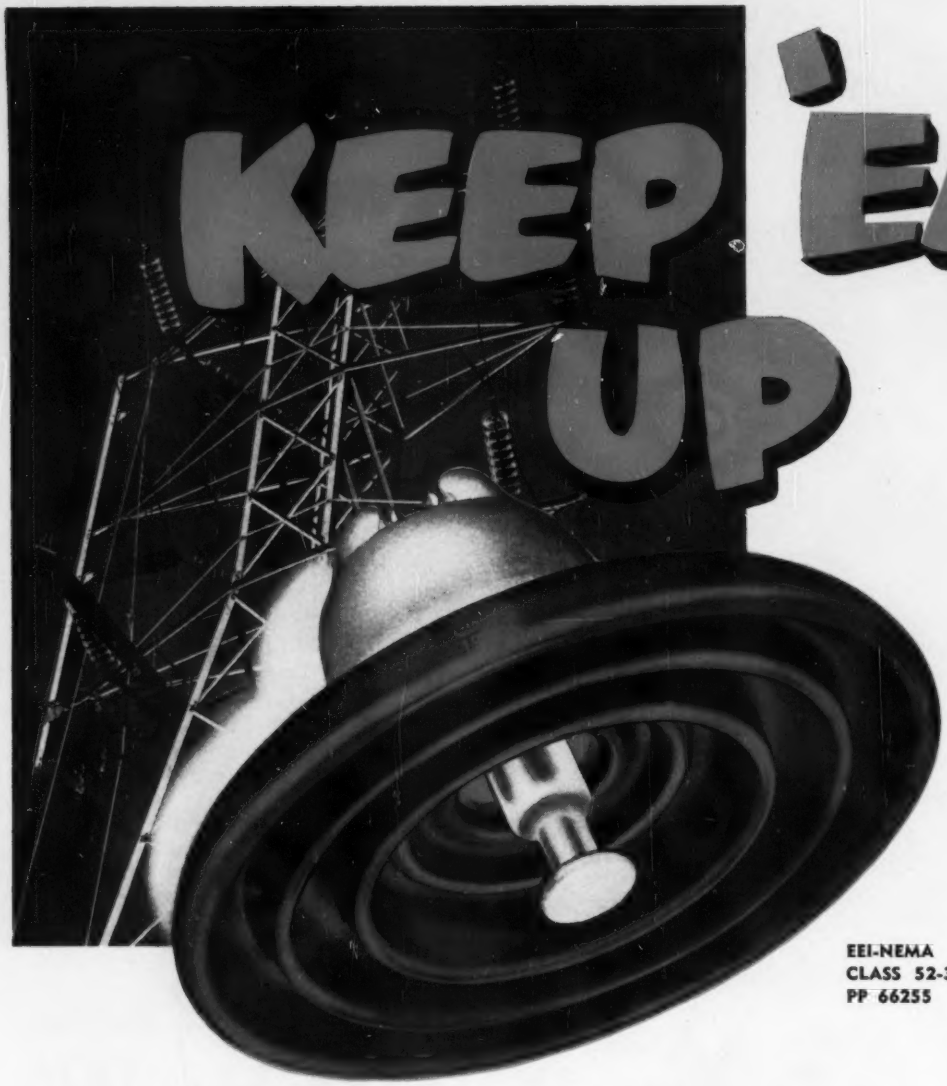
TYPE AUR



TYPE ACF

TYPE ATTC

KEEP 'EM UP



EEI-NEMA
CLASS 52-3
PP 66255

PP INC.

WHY GAMBLE . . . on anything but RECOGNIZED RELIABILITY! We don't make any bones about it, our insulators are *second to none.* PORCELAIN PRODUCTS Insulators are subjected to rigid factory controls in *every* phase of production. Field proven over extended periods of years setting unparalleled standards of reliability and dependability.

Buy PORCELAIN PRODUCTS INSULATORS — buy RECOGNIZED RELIABILITY!

Porcelain Products, Inc.
High Voltage Division **Parkersburg, W. Va.**

In Taconite processing plant, ANACONDA Interlocked-armor cable is used for feeder line . . . resists weather and industrial hazards.

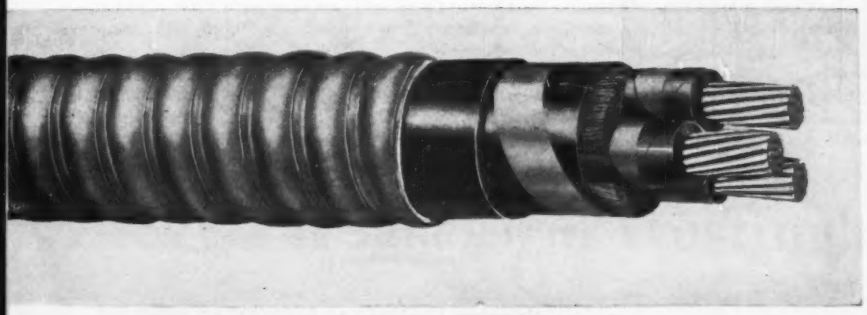
New cable puts power where you want it—fast!

With ANACONDA Interlocked-armor cable you bring power to new load centers faster—change plant layout quickly, or add new facilities in a hurry!

It is economical—installed fast—indoors or out—with simple supporting devices . . . trained easily around corners, columns and other obstructions in long unbroken runs. Circuits are easy to relocate . . . always accessible. And this cable's interlocked metal-tape armor affords high mechanical protection against all types of damage.

The Man from Anaconda, or your nearest Anaconda distributor, will be happy to give you full information. Or write to: Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York. 54308

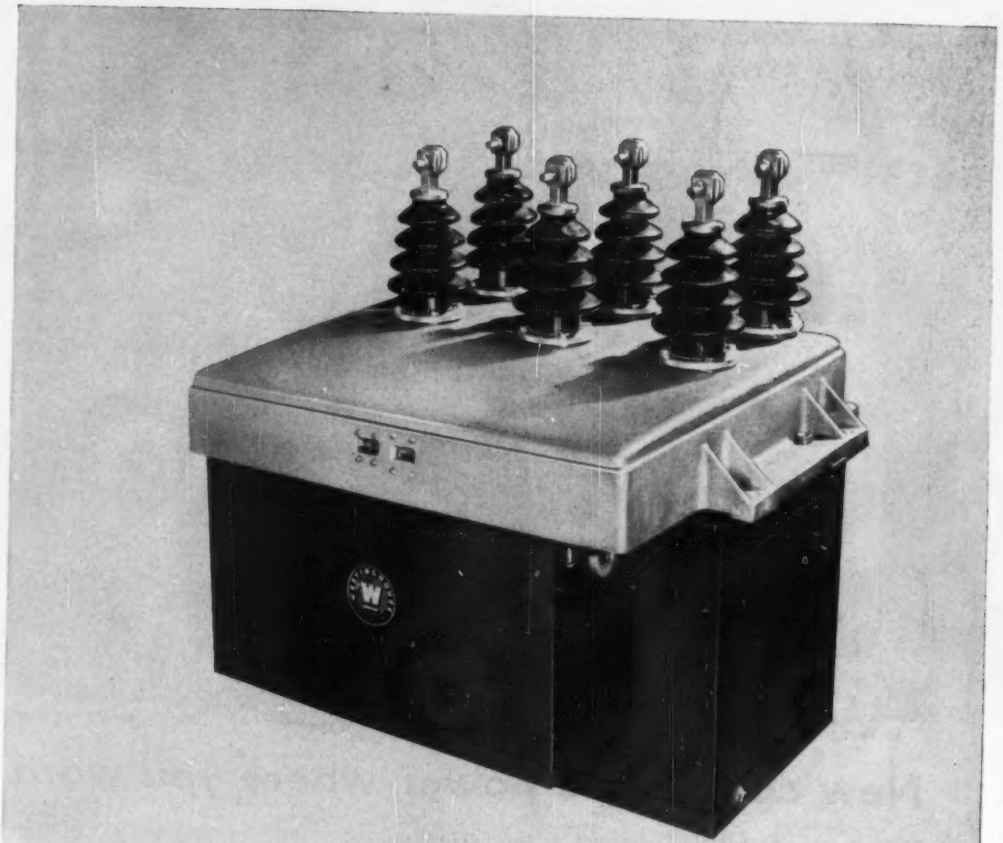
ASK THE MAN FROM ANACONDA® FOR INTERLOCKED-ARMOR CABLE



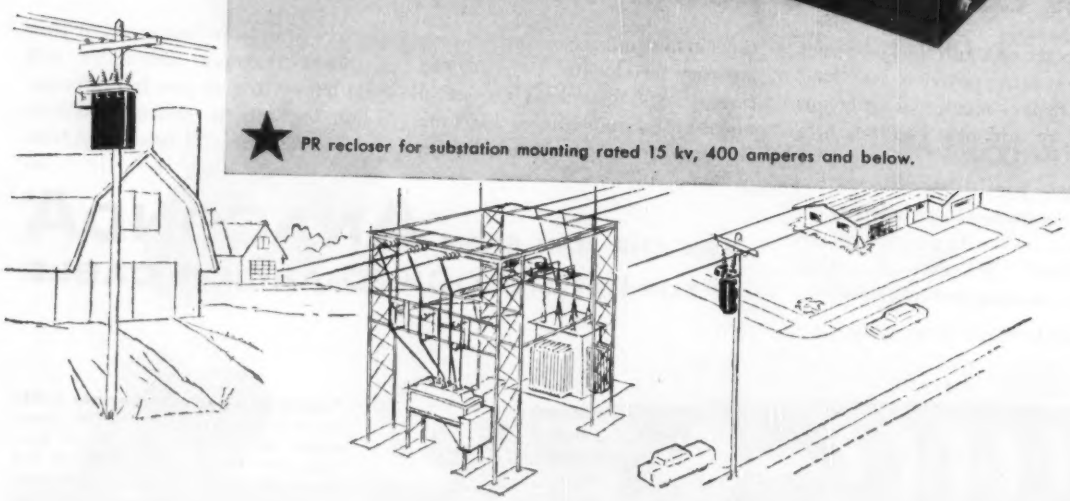
Anaconda Interlocked-armor cable comes in sizes No. 6 Awg to 750 Mcm—copper or aluminum—up to 15 kv—Underwriters' approval for 600 volts and 5000 volts. Available with rubber-, plastic- or varnished-cambric-type insulation.

THE WESTINGHOUSE RECLOSER LINE PRESENTS...

Featurama ...an unmatched

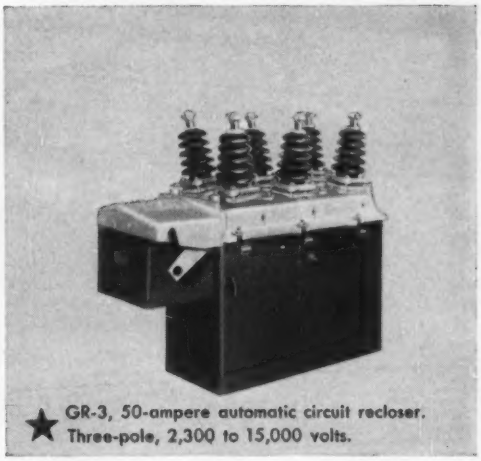


★ PR recloser for substation mounting rated 15 kv, 400 amperes and below.

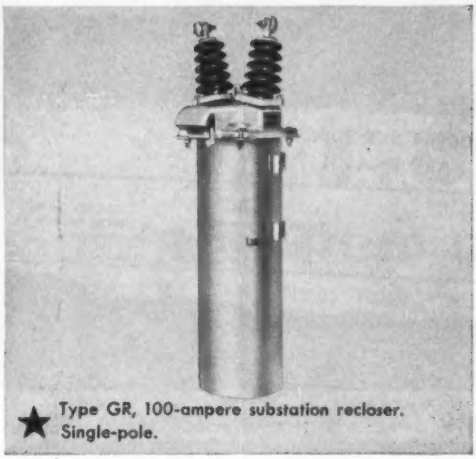


but widely imitated all★star production

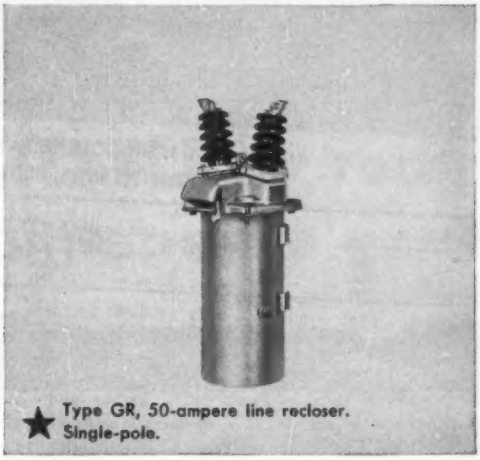
★ GR-3, 100-ampere automatic circuit recloser. Three-pole, 2,300 to 15,500 volts.



★ GR-3, 50-ampere automatic circuit recloser. Three-pole, 2,300 to 15,000 volts.



★ Type GR, 100-ampere substation recloser. Single-pole.



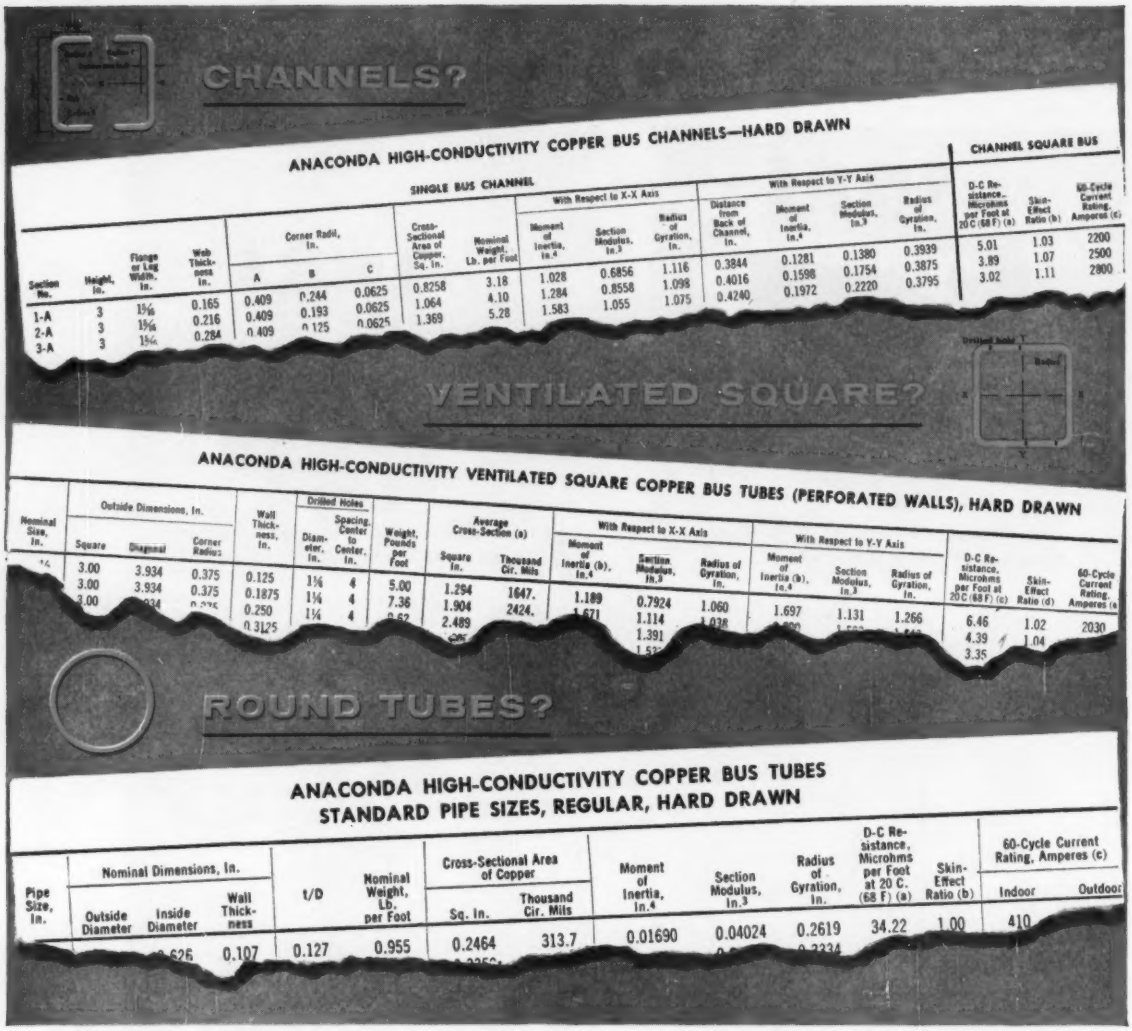
★ Type GR, 50-ampere line recloser. Single-pole.

★ Get these NEW features: ★ Big operation counter can be read from the ground—the only one that can be reset. ★ One-piece aluminum head casting gives better seal, less maintenance, longer life. ★ Manual operating handle shaft-sealed against dirt and moisture. Plus these long-time standards: ★ One-half to two-thirds as many parts. ★ Simple, reliable. ★ Exclusive De-ion® interrupter arc-quenching. ★ Single operation to lock out if manually closed on fault, not full-automatic cycle with resultant extra wear. ★ Time delay on manual close on cleared circuit rides through inrush load pickup. ★ Seamless, weldless, galvanized drawn-steel tank eliminates need for painting. ★ Integral surge and lightning protection in bushing-mounted arrester. ★ Two-to-three-cycle opening and power restoration. ★ Hydraulic timing—nine combinations of instantaneous and time-delay operation. ★ Bushings, coils and contact details interchangeable in 50- and 100-ampere series. ★ Built to the quality standards of the Westinghouse circuit breakers. ★ For complete details, ask your Westinghouse sales engineer or distributor for booklet B-4339—or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh, Pa.

J-60897

YOU CAN BE SURE...IF IT'S Westinghouse

Which Bus Shape for Your System?



CHANNELS?

ANACONDA HIGH-CONDUCTIVITY COPPER BUS CHANNELS—HARD DRAWN

Section No.	Height, In.	Flange or Leg Width, In.	Web Thickness, In.	Corner Radii, In. A	B	C	Cross-Sectional Area of Copper, Sq. In.	Nominal Weight, Lb. per Foot	With Respect to X-X Axis: Moment of Inertia, In.⁴	Section Modulus, In.³	Radius of Gyration, In.	With Respect to Y-Y Axis: Distance from Back of Channel, In.	Moment of Inertia, In.⁴	Section Modulus, In.³	Radius of Gyration, In.	Channel Square Bus: D-C Resistance, Microhms per Foot at 20 C (68 F) (a)	Skin-Effect Ratio (b)	60-Cycle Current Rating, Amperes (c)
1-A	3	1⅛	0.165	0.409	0.244	0.0625	0.8258	3.18	1.028	0.6856	1.116	0.3844	0.1281	0.1380	0.3939	5.01	1.03	2200
2-A	3	1⅛	0.216	0.409	0.193	0.0625	1.064	4.10	1.284	0.8558	1.098	0.4016	0.1598	0.1754	0.3875	3.89	1.07	2500
3-A	3	1⅛	0.284	0.409	0.125	0.0625	1.369	5.28	1.583	1.055	1.075	0.4240	0.1972	0.2220	0.3795	3.02	1.11	2800

VENTILATED SQUARE?

ANACONDA HIGH-CONDUCTIVITY VENTILATED SQUARE COPPER BUS TUBES (PERFORATED WALLS), HARD DRAWN

Nominal Size, In.	Outside Dimensions, In.: Square	Diagonal	Corner Radius	Wall Thickness, In.	Drilled Holes: Diameter, In.	Spacing, Center to Center, In.	Weight, Pounds per Foot	Average Cross-Section (a): Square In.	Thousand Cir. Mils	With Respect to X-X Axis: Moment of Inertia (b), In.⁴	Section Modulus, In.³	Radius of Gyration, In.	With Respect to Y-Y Axis: Moment of Inertia (b), In.⁴	Section Modulus, In.³	Radius of Gyration, In.	D-C Resistance, Microhms per Foot at 20 C (68 F) (c)	Skin-Effect Ratio (d)	60-Cycle Current Rating, Amperes (e)
	3.00	3.934	0.375	0.125	1¼	4	5.00	1.294	1647.	1.189	0.7924	1.060	1.697	1.131	1.266	6.46	1.02	2030
	3.00	3.934	0.375	0.1875	1¼	4	7.36	1.904	2424.	1.671	1.114	1.038				4.39	1.04	
	3.00			0.250	1¼	4		2.489			1.391					3.35		
				0.3125														

ROUND TUBES?

ANACONDA HIGH-CONDUCTIVITY COPPER BUS TUBES
STANDARD PIPE SIZES, REGULAR, HARD DRAWN

Pipe Size, In.	Nominal Dimensions, In.: Outside Diameter	Inside Diameter	Wall Thickness	t/D	Nominal Weight, Lb. per Foot	Cross-Sectional Area of Copper: Sq. In.	Thousand Cir. Mils	Moment of Inertia, In.⁴	Section Modulus, In.³	Radius of Gyration, In.	D-C Resistance, Microhms per Foot at 20 C. (68 F) (a)	Skin-Effect Ratio (b)	60-Cycle Current Rating, Amperes (c): Indoor	Outdoor
		.626	0.107	0.127	0.955	0.2464	313.7	0.01690	0.04024	0.2619	34.22	1.00	410	

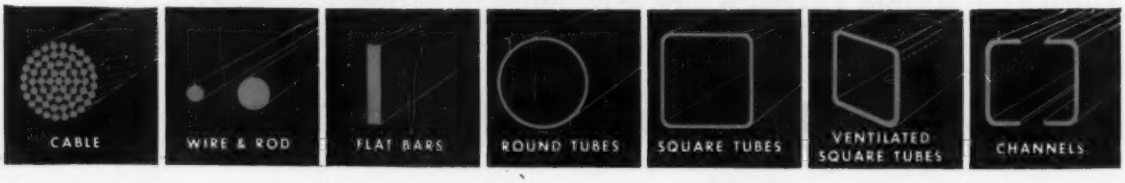
The table headings above are typical of the new information just published by The American Brass Company—to help make the selection of bus conductors easier and quicker. There are comparable tables for other rigid bus conductor shapes in the more commonly used sizes. In addition, convenient data is available for bare copper wire and cable and the most widely used Anaconda alloy wires.

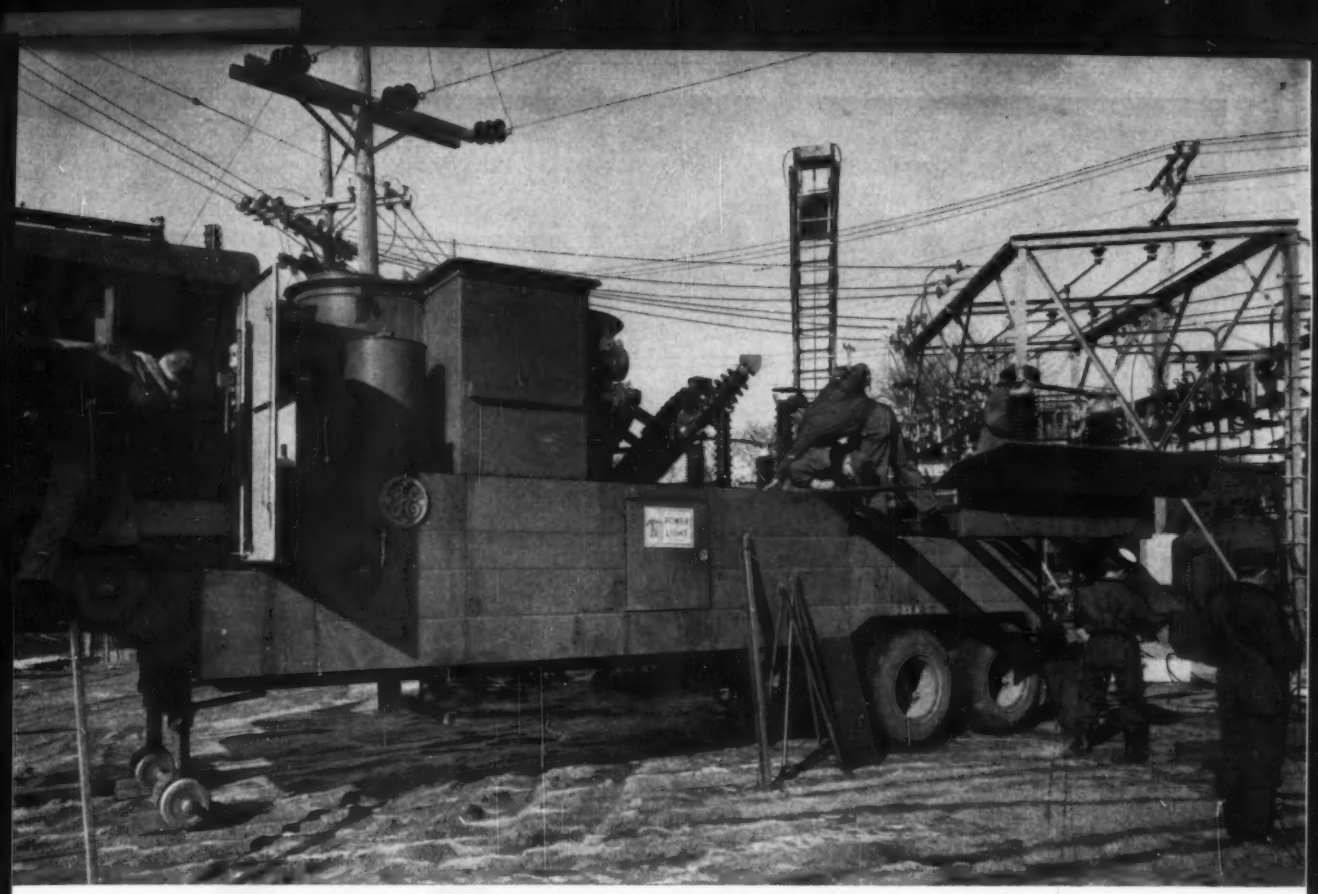
For preliminary analysis—for many normal jobs—this new information can save you time, eliminate lengthy calculations. You'll find it in the brand-new Fifth Edition of The American Brass Company's 62-page Publication C-25, "Anaconda Copper for Electrical Conductors," which has much hitherto unpublished information to help you.

The services of The American Brass Company's Technical Department are available to help you in the solution of special problems involving the use of Anaconda Bus Conductors. For such help—or for a copy of "Anaconda Copper for Electrical Conductors"—see your nearby Anaconda representative. Or write: The American Brass Company, Waterbury 20, Conn. 56101

ANACONDA® COPPER CONDUCTORS

THERE'S AN ANACONDA ELECTRICAL CONDUCTOR FOR EVERY NEED





GENERAL ELECTRIC Mobile Unit Substation

PAYS FOR ITSELF by reducing routine system maintenance expense

"We certainly feel that this unit is paying for itself during routine maintenance. Variations in voltage make it adaptable in many locations for a variety of jobs." This statement by Mr. Anthony Zanskas, Assistant Superintendent of Substation Construction and Maintenance, Wisconsin Power and Light, expresses the findings of many progressive utilities.

"Labor and material savings, by using the mobile unit substation for by-passing entire small substations for maintenance and transformer changes have been great, as we have been able to do this work on de-energized busses and equipment with a minimum amount of material and preparation and without any delay or outages." This additional endorsement by Mr. Carl Takle, Wisconsin P & L's Superintendent of Substation Construction and Maintenance, further demonstrates how General Electric mobile unit substations are paying off as a versatile, economical means of speeding routine system maintenance, in addition to their value as stand-by or emergency equipment.

General Electric mobile unit substations are designed for maximum versatility, with provision for various voltage combinations, if required, to meet all application needs. Each substation is a complete, fully coordinated unit, mounted on a high-speed trailer, designed for normal highway operation. For further information, contact your local G-E Apparatus Sales Office or write for bulletin GEA-4415 to General Electric Co., Schenectady 5, N. Y. 422-26

Typical six-months' operating log for Wisconsin P & L's 5000-kva G-E Mobile Unit illustrates high utilization factor. All these stops were for routine maintenance.

Location	Installed	Removed	Days	Mileage
Oregon	2–22–55	3– 6–55	13	25
Tomah	3–10–55	3–16–55	7	110
Prairie Du Chien	3–18–55	3–18–55	1	94
Baraboo	4–19–55	4–23–55	5	98
Fox Lake	5– 7–55	5–18–55	12	35
Janesville	6– 7–55	6–29–55	23	82
Mauston	7–12–55	7–19–55	8	100
Dorset	7–21–55	7–22–55	2	10
Darien	8–11–55	8–11–55	1	120
Portage	8–19–55	8–20–55	2	90
Evansville	8–23–55	8–23–55	1	45

SIX-MONTH TOTALS: 11 Locations
75 Days in Service—809 Miles Traveled

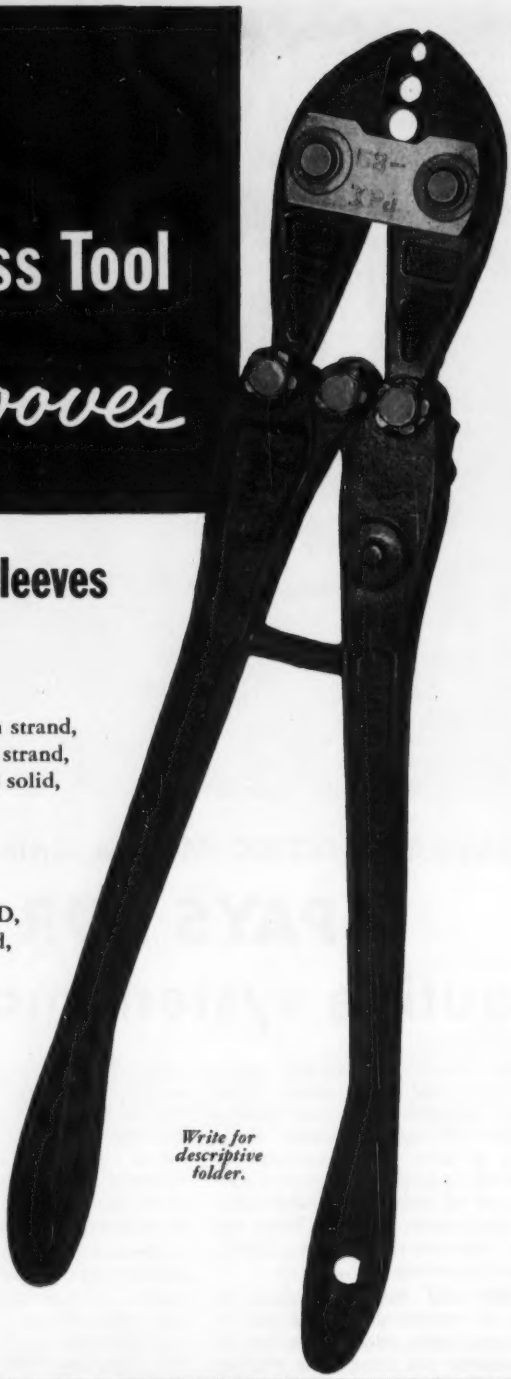
Progress Is Our Most Important Product

GENERAL ELECTRIC

NEW

No. 53-XPJ Nicopress Tool

with *Three Grooves*



Accommodates Nicopress Sleeves

FOR COPPER
1 solid, 1 seven strand, 2 solid, 2 seven strand, 2 three strand, 3 solid, 4 solid, 4 seven strand, 4 three strand, 6 solid, 6 seven strand, 8 solid, 8 seven strand, 3 No. 10, 3 No. 8.

FOR COPPERWELD
4A, 6A, 8A, 6C, 8C, 6D, 8D, 9½D, 3 No. 10, 3 No. 12, 4 solid, 6 solid, 8 solid, 10 solid.

FOR ALL-ALUMINUM
2 solid, 2 seven strand, 4 solid, 4 seven strand, 6 solid, 6 seven strand, 8 solid.

FOR AMERDUCTOR
8SCP or SCG, 10SCP or SCG, 12SCP or SCG.

Write for descriptive folder.

Nicopress Sleeves and Tools Patented in U. S. and Foreign Countries. "Nicopress" Registered in U. S. and foreign countries.

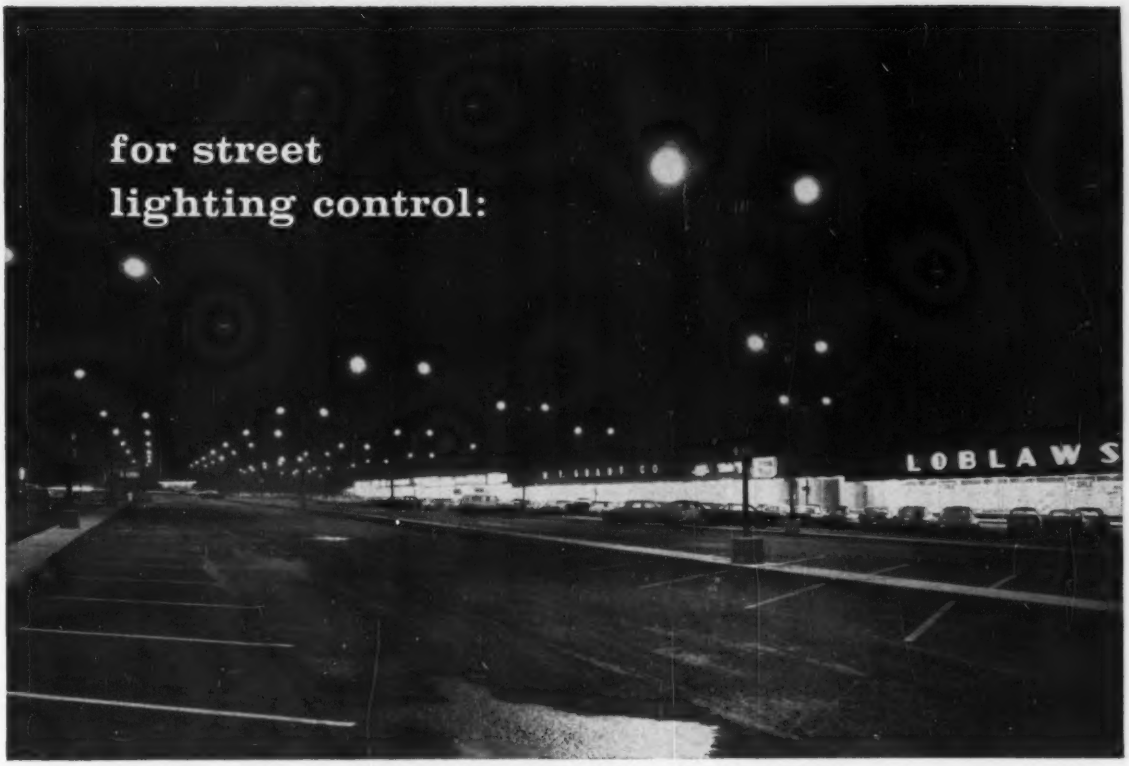
The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.: N. SLATER CO., LTD., HAMILTON, ONTARIO, CANADA

Export Distributor: INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY



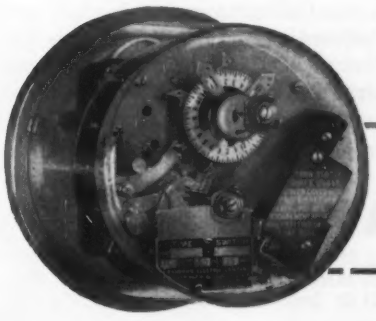
SANGAMO TIME SWITCHES

are economical to use because maintenance costs are low!

Street lighting maintenance costs go *down* when you use Sangamo Time Switches for control. That's why many street lighting engineers are switching to trouble-free Sangamo controls as part of their modernization programs.

The Sangamo WSZ socket type time switch provides unfailing on-off control for this purpose—even in bad weather. The *astronomic dial* automatically compensates for daily changes in operating time—all year 'round. The *automatic carryover* keeps the switch running for up to 10 hours if power fails—no resetting is necessary. The *socket mounting* means easy installation and quick replacement.

Type WSZ Synchronous Time Switch for socket mounting.



Check into this cost-cutting control method today. Call your Sangamo Representative or write Sangamo Electric Company, Springfield, Illinois for full information.

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

ST 56-7

In the 4th Century B.C., Damocles so admired royal luxury that Dionysius, the monarch of Syracuse, decided to demonstrate to him how precarious is the position of one in power. At a banquet he feasted Damocles in regal fashion. It was not until the dinner was well under way that Damocles noticed a naked sword suspended above his head by a single hair. *Damocles' Sword* has since come to represent an ever-present danger.

POINT OF DANGER

There is a constant menace to cable directly buried in the ground, laid under water, or exposed to the air. The ravages of the elements hang as a threat like Damocles' Sword over cable unable to resist them . . . time itself makes inroads. Fortunately—but not accidentally—Kerite Cable is designed to "outlive," by many years, the destructive conditions of today and tomorrow. From the Arctic to the Tropics, Kerite Cables have served under the most adverse conditions. Unlike Damocles' Sword, Kerite, wherever it serves, engenders confidence.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

Founded 1854

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco;
3901 San Fernando Rd., Glendale 4, Calif.; 31 St. James Ave., Boston

EDITORIALS

Let Computers Analyze Your Service Quality

The pace of progress has been slow to date in gathering and analyzing the detailed data on system performance. This data is fundamental to a precise determination of what constitutes satisfactory electric service . . . and what steps must be taken to provide it.

We lack the factual basis for determining the quality of service that will be required for the all-electric home and "automatic factory" of the future.

A growing number of companies have been compiling and analyzing interruption data in search of an answer. But until recently the sheer weight of manual analysis required has been such that only a few utilities have kept records in enough detail to make possible any satisfactory comparison of performances.

Happily modern electronic data processing is lifting the burden of manual analysis. Already several utilities punch their interruption histories on analysis cards or otherwise record them for machine tabulation. We also have several new load survey data recording devices, recently introduced for use with automatic data processing equipment. Therefore the means are at hand for gathering far more extensive and diversified system data than we could have hoped to compile by manual methods a few short years ago. From it we will be able to learn not only what kind of service is being provided but also what types of system design are unsatisfactory and what correctives have proved to be most effective.

Moreover, as these data gathering and processing devices are brought to bear on the problem, there will be more opportunities to compare performance among companies. The pooling of information thus made possible can provide a vast reservoir of diversified experience to use in solving design problems. In turn each participating company will have available data it needs to provide a better quality of service for all its customers.

Let's Identify Engineers

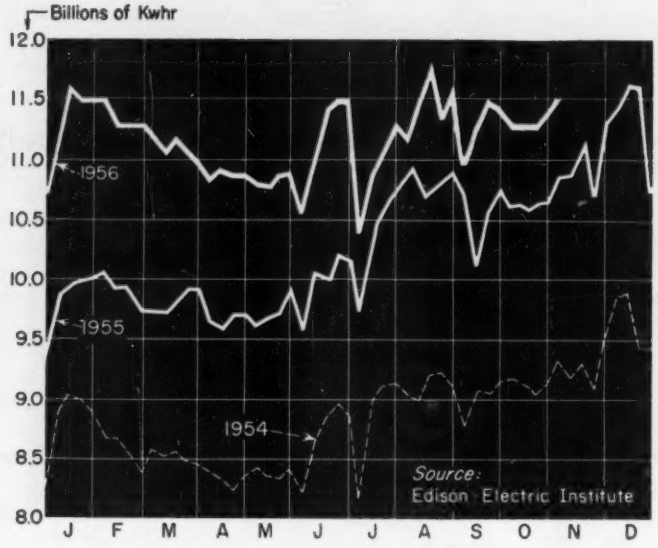
Any discussion of the shortage of engineers these days inevitably brings out how little the public knows and appreciates the contribution of engineers to community life. By contrast the medical and legal professions are held in the highest esteem. But the little-known truth is that all three professions are ranked on an equal level among the few people who know and understand them well.

In every community there are many respected citizens who are engineers; yet the public doesn't know they are engineers. They are identified by the position they hold or their occupation. How many people know that Herbert Hoover is a mining engineer? That Eugene Grace, a leading steel executive, is an electrical engineer? That Harland Forbes, president of Consolidated Edison Co, is an electrical engineer? Very few! Yet if any of these gentlemen were medical doctors or lawyers, practically everyone would know it because they would be using the title of "doctor" or "attorney at law".

Nothing would raise the engineering profession so quickly in the public eye as the use by qualified engineers of the designation E.E. or M.E. or C.E., etc, with their names. If engineers identified themselves, as they do in Europe, the public would become more aware of the contribution that the profession is making every day to the community life of this country.

Let's identify ourselves.

ELECTRICAL WEEK



OUTPUT

Week ended Nov. 3, 11,487,000,000 Kwhr Up 5.8%

Atomic Energy Commission requirements—1,125,000,000 kwhr (Electrical World estimate). Excluding AEC, output increase was 5.7%

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Nov. 3	+5.8	+5.6	+5.5	+3.1	+6.7	+4.0	+12.0	+9.5	+12.7	+8.0
Oct. 27	+6.9	+7.5	+5.5	+5.6	+7.3	+5.9	+11.6	+8.6	+10.8	+7.8
Oct. 20	+6.5	+4.5	+3.4	+4.5	+8.6	+4.8	+18.0	+7.8	+13.5	+6.6

Seasonally Adjusted Index 219.7 Week Ago 219.0 Year Ago 207.4

Here are the issue's highlights . . . Status quo expected on matters of federal power policy as voters give little guidance to White House or Congress . . . New strides of infant atomic power field highlighted . . . Hells Canyon progress: Brownlee tunnel completed . . . Corps of Engineers drafts new lower Snake plan . . . Builder is key to successful all-electric promotions . . . Pioneering design of two 290-Mw, cross-compound, 2,350-psi turbines announced by PS Electric & Gas (N. J.) and Westinghouse . . . Blocking scheme protects sectionalized bus, can be left in service during switching . . . Capacity, voltage, frequency, continuity and personnel are foundations on which to build service quality . . . New recorder produces punched tape record of watthour demand . . . Money back guarantees, dealer incentives, and employee sales leads are ways to bolster dryer sales.

Two super co-ops have filed applications with Mississippi PSC involving transmission interconnections, a 100-Mw plant near Meridian, a 50-Mw plant near Yazoo City, and three ties with TVA. The two co-ops, South Mississippi Electric Power Assn and West Mississippi Electric Power Assn, claim a service area embracing almost the entire state excepting the area served by TVA.

British firm tops six American bids on two auto-transformers for 750,000-kw steam plant planned by Memphis. Proposals, awaiting evaluation by Burns & Roe, consulting engineers, show English Electric Export & Trading Co, Ltd, asked $441,520 while American bids ranged from above $436,000 to $580,000.

Congratulations . . . Duke Power Co's Orris J. Miller, vice president and general manager, moves up to newly created post of executive vice president, and William B. McGuire becomes assistant to the president, another new position . . . **New England Electric System** has elected Leeds A. Wheeler vice president and general counsel.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Washington Wire . . . AEC invites industry to submit proposals for purchase of uranium-magnesium-fluoride slag and recovery of the contained uranium by processing the material in privately owned facilities. Uranium would be purchased by AEC . . . **New regulation is issued by AEC** defining those records relating to its regulatory activities available for public inspection.

FPC has dismissed an application for permanent emergency-use-only connection between Commonwealth Edison and Wisconsin Electric Power. The agency ruled that the companies are public utilities subject to its jurisdiction.

REA appoints William E. Spivey chief of Information Services Division replacing Kermit Overby, resigned. Spivey has been acting chief since August.

NRECA General Manager Clyde T. Ellis accuses "monopolistic power companies" of "growing attempts to buy out prosperous rural electric systems" and asserts that "these efforts will continue to grow unless we start fighting back." He proposes the formation of "task forces" which would operate as rescue squads ready to meet a "sell-out" threat whenever it appears.

American & Foreign Power Co orders third 10,000-kw nuclear power reactor from International General Electric for probable installation in Mexico. The other two units are slated for Cuba and Brazil.

Delay in construction of Rocky Reach Dam is expected as result of Douglas County PUD's decision to appeal Chelan County PUD's license for the Columbia River project. Douglas contends that FPC's compensation for encroachment of Rocky Reach reservoir on its upstream Wells damsite is inadequate.

Chicago voters have approved a $10-million bond issue to continue street lighting modernization program underway for several years.

Puget Sound-Cascade Power Pool discloses saving of 13-million kwhr, or over $100,000, in first two months of operation. Saving is estimated at "more than ten times the cost of operating the power pool for an entire year."

ABOUT PEOPLE IN THE INDUSTRY

The nation's annual consumption of electricity will jump from today's 500-billion kwhr to a trillion kwhr by 1965 or earlier, predicts **Don G. Mitchell,** chairman and president of Sylvania Electric Products, Inc. Envisioning a similar doubled output by the combined electrical-electronics manufacturing industries, he cited the rise from $17½ billion of 1955 to this year's probable $20 billion. By 1965 shipments will be about $40 billion.

Virginia Electric & Power Co has become a $500-million company, reports Treasurer **S. E. Ratcliffe.** He said VEPCO, rated 12th largest private electric utility in the U. S. by the State Chamber of Commerce, passed the milestone while spending $50-million for construction in 1956. Ratcliffe credits a large portion of the growth to a sharp rise in average annual electricity use by individual customers, which make up 45% of VEPCO revenues.

More News About People page 236

Post-Mortem: What Did the Election Show?

Voters gave little guidance to Ike on power policies. As many questions are posed as are answered . . .

Eisenhower Administration power policies will for another four years dominate Washington news of interest to electric utilities.

For two years at least, such policies will be advanced against the same resistance they've had for the past two—a Congress in which the Democrats control both the House and Senate.

The truth is that the nation's voters in their fateful trip to the polls last Tuesday gave little guidance either to the White House or to Congress in the important matter of federal power policy. The Administration's philosophy—partnership, decreased reliance on federally produced power, and less federal spending for power projects—seems likely to fare in the next two years very much as it has fared during the past four years.

Full significance of Tuesday's election cannot be evaluated until there have been actual tests in the Administration and the Congress. Such tests are certain to come on a host of legislative proposals relating to atomic power, the Hoover Commission's report, federal power rates, and other such matters (EW, Nov. 5, p 8).

An initial glance at the election results poses as many questions as answers regarding federal power policy. Take a look at the patchwork quilt which the voters pieced together at the polls:

• In the Far West where Democrats sought to make power and water resources a top issue, they scored some impressive state victories. But while the western voters turned down such Eisenhower-picked candidates as Douglas McKay in Oregon, Arthur B. Langlie in Washington, and Dan Thornton in Colorado, they turned out handsome majorities for President Eisenhower, himself.

• Voters in Indiana and Minnesota seemed to be saying "a plague on both your houses" to two former chiefs of the Rural Electrification Administration. In Indiana they turned down Democrat Claude Wickard's bid for the Senate. And in Minnesota they turned down Ancher Nelsen's bid for governor.

• Idaho voters defeated Herman Welker, Republican Senator who had actively supported the Idaho Power Co development of Hells Canyon. They replaced him with Frank Church who now considers the Hells Canyon controversy closed but is plugging for federal storage projects upstream.

• New York voters gave the nod to Republican Jacob K. Javits for Senator to replace the longtime New Dealer Herbert H. Lehman. But Javits' power views, probably close to those of former Gov Thomas E. Dewey, played no part in the campaign.

Ike: Facing New Puzzlers

• Voters in Tennessee and Kentucky, usually believed to support strongly the Tennessee Valley Authority, gave the nod to Eisenhower although his Administration has been accused of seeking to undermine the power agency. Kentucky followed this up with approval of Republican Senator John Sherman Cooper who had previously failed in attempts to gain more Administration consideration for TVA.

With Democratic majorities in both houses, the all-important committee chairmanships remain with the Democrats. Only change of significance in this area is that Democratic Rep Carl T. Durham (N. C.) will take over as chairman of the Joint Atomic Energy Committee, replacing Sen Clinton P. Anderson (N. M.). This takes place under the two-year rotation system between the House and Senate. Durham is more conservative, less volatile than Anderson.

In the Administration there are two men to watch for a tipoff in changes of power policy. Number one is Fred Seaton, Interior Secretary, who took over from McKay earlier this year. His policy statements thus far have been buried in the election campaigns. Some people are tagging Seaton as future presidential material. Other man to watch is Herbert Brownell, Jr, who wrote the opinion strengthening the preference clause. A rumor now making the rounds in Washington holds that Brownell will step out of the Administration before the inauguration in January.

The Administration is certain to try again to get the Fryingpan-Arkansas project passed by Congress. This was defeated during the last session after the Administration was accused of helping to kill the Hells Canyon measure. Other hydroelectric projects will be proposed by the Administration.

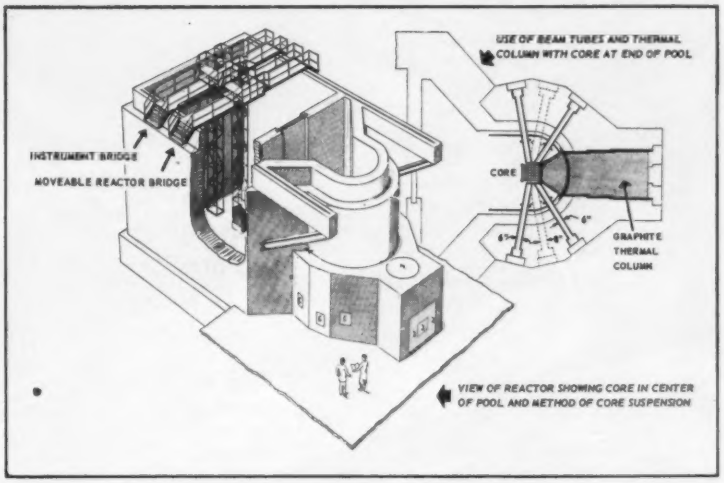
Before Atom Power Learns to Walk...

Like other infants, atomic power must learn to crawl before it learns to walk. Last week it chalked up impressive progress with announcements of:

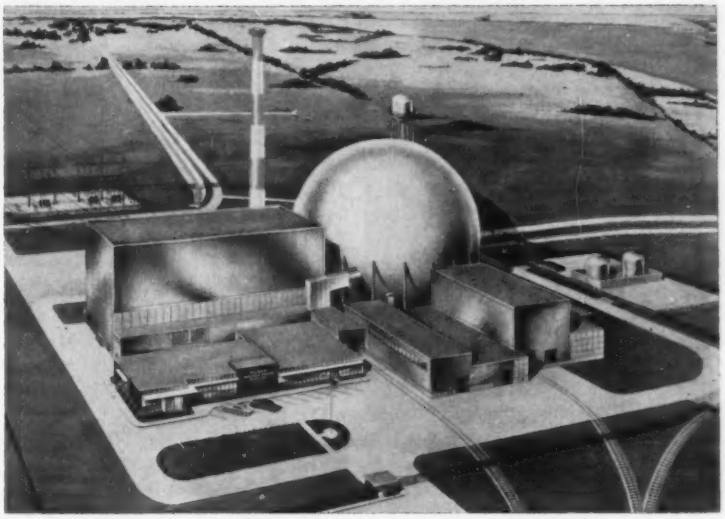
- Completion of the nation's first privately owned Nuclear Research Center at Battelle Institute.
- Construction next spring of Dresden Nuclear Power Station for the Nuclear Power Group.
- Atom-generated electricity going out over a California utility's lines on a commercial basis early next year.
- Operation of the midwest's first atomic reactor expected within 60 days.

Situated 15 miles from Columbus, Ohio, Battelle's new research center is a direct descendant of the Atomic Energy Act of 1954. Capable of producing 1,000 kw, the "pool type" unit was conceived in anticipation of industrial research that would be made possible by industrial use of the atom.

The $750,000 reactor is the largest of its kind yet to be put in service in the U. S. Holding solid U-235 fuel, the 3-cu-ft core is suspended 22 ft below the surface in a large pool of highly purified water. The reactor is designed for "extreme versatility and flexibility." It will be used in research on the chemistry of petroleum, sterilization of pharmaceuticals, preservation of foods, and improvement of chemical, glass, plastic, ceramic, and metallic products and processes.


USE OF BEAM TUBES AND THERMAL COLUMN WITH CORE AT END OF POOL
INSTRUMENT BRIDGE
MOVEABLE REACTOR BRIDGE
CORE
GRAPHITE THERMAL COLUMN
VIEW OF REACTOR SHOWING CORE IN CENTER OF POOL AND METHOD OF CORE SUSPENSION

Battelle's Reactor Generates 1 Mw for Industry



Commonwealth Ed's Plant to Make Commercial 180 Mw

180-Mw Atom Plant Planned

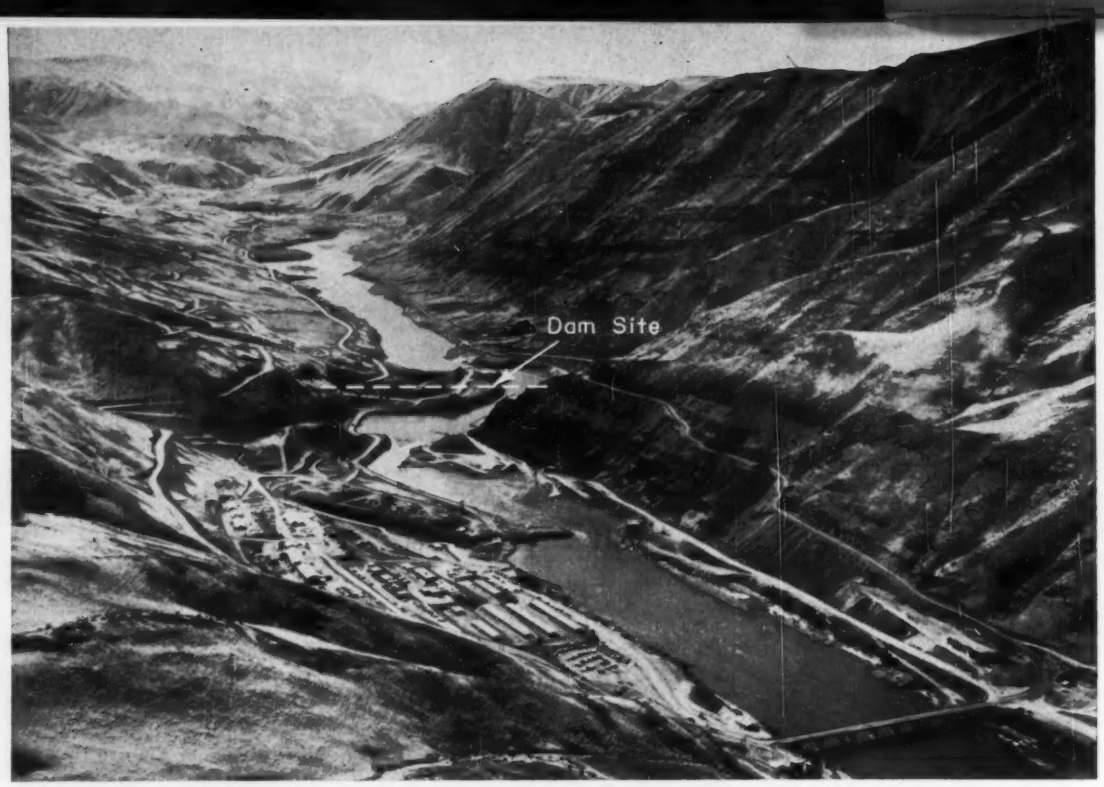
Commonwealth Edison Co reports that Nuclear Power Group next spring will start work on its plant, with completion expected about mid-1960. The nuclear reactor for this 180-Mw station (the largest all-nuclear power plant yet scheduled in the U. S.) will be housed in a steel sphere 190 ft in diam. To be financed entirely by private funds, the project will be situated on the Illinois waterway 50 miles southwest of Chicago. It will become part of Commonwealth's system.

Associated in Nuclear Power Group with Commonwealth Ed are American Gas & Electric Service Corp, Bechtel Corp, Central Illinois Light Co, Illinois Power Co, Kansas City Power & Light Co, Pacific Gas & Electric Co, and Union Electric Co of Missouri.

Atom power will go out over transmission lines early next year from an atomic plant being constructed by Atomics International (a division of North American Aviation, Inc). Southern California Edison Co is installing the generator for this Sodium Reactor Experiment, and will take power it generates. The plant is 30 miles from Los Angeles in the Santa Susana mountains.

Fred W. McCloska of Sargent & Lundy predicts that the Atomic Energy Commission's Argonne National Laboratory near Lemont, Ill., will be producing power in about 60 days. He said the plant is designed to generate 5,000 kw, but the power will be consumed by the laboratory. It will be the fifth operating atomic generator in the country. It is designed as a model for subsequent commercial units.

In another development, Westinghouse scientists announced they can see stresses in steel pressure vessels by using models made of a special plastic. This will help designers equip reactors with shells to withstand emergency pressures.



Idaho Power starts construction at Snake River site of projected dam as . . .

Brownlee Diversion Tunnel Is Completed

After seven months of blasting and drilling in the solid rock canyon wall of the nation's deepest river gorge, Idaho Power Co has completed the 2,540-ft-long diversion tunnel which will re-route the Snake River and make way for construction of its controversial $63-million Brownlee Dam.

Despite continuing attempts by public power advocates to halt its construction, the 395-ft-high dam is moving along on schedule. Pumps are now drying out the dam site for excavation to solid foundation.

The river, barred by coffer dams from its regular bed, will flow through the 38-ft-diam horseshoe tunnel until the rock-fill dam is completed in mid-1958. The tunnel will then be closed with two 270-ton gates to enable the 58-mi reservoir to be filled back of the dam.

Brownlee, which will stretch 1,320 ft across the canyon, will initially have a 360,000-kw powerhouse of four units, with provision for a fifth.

It is the first of three low-head dams which Idaho Power plans to build on the Snake. Others are Oxbow, 13 mi. below Brownlee, and Hells Canyon, 23 mi. farther downstream.

To prepare for the influx of workers, which is expected to reach 1,100 this spring, construction of another type is also underway. Housing facilities are growing, including the completion of 13 permanent residences and an 180-family trailer camp.

Construction will also turn to a school system for children of the workers. The village already boasts of two schools now in operation, numerous roads, and a heavy-duty bridge across the river.

Idaho Power, said Pres T. E. Roach, "will exert every possible effort to expedite the construction at Brownlee, Oxbow, and Hells Canyon. The welfare of the region," he added, "is wrapped up closely with the availability of abundant low cost electric power and Hells Canyon is of vital importance. Any delay is dangerous to the area's economy."

HALF-MILE tunnel detours Snake

ELECTRODES (right) divert fish to trap for trucking around dam

New Plan for Lower Snake . . .

. . . proposed by Corps of Engineers. Would eliminate Clarkston Dam, raise heights of three other dams

Alternative plan for hydroelectric development of the lower Snake River in the vicinity of Lewiston, Idaho, is being considered by the Army Corps of Engineers. Whether or not the new four-dam plan will replace the former five-dam plan submitted to Congress will depend on the outcome of hearings being conducted by the Corps in the area affected. The alternative plan appears to offer higher production capacity and lower costs. Estimated cost under the new plan would be $370 million as compared with $460 million under the existing plan.

As presented last month by Col Myron E. Page, Jr, Walla Walla district engineer, before a joint meeting of the city councils of Lewiston, Idaho, and Clarkston, Wash., the alternative proposals differ in five major aspects from previous plans. These are:

1. Height of Lower Granite Dam at river mile 113.1 would be raised from 82 to 102 ft to maintain a constant slackwater level at Lewiston of 735 ft. Previous plan would have permitted a fluctuating level from 715 to 735 ft.

2. Eliminate the proposed dam at Clarkston.

3. Relocate the proposed Asotin Dam approximately four miles upstream from the previous site—at river mile 146.8 rather than at mile 151.

4. Relocate the proposed China Gardens Dam upstream at river mile 172.5 rather than mile 176. The new site would be 5 miles above the confluence of the Snake and the Grand Ronde rivers on the Snake.

5. Increase the heights of the China Gardens Dam from 90 to 107.5 ft, and Asotin Dam, from 100 to 107.5 ft. These increases would provide a 215-ft rise in the river upstream to the Mountain Sheep damsite.

Col Page explained the engineers are revising their previous reports for lower Snake development and hope to have recommendations ready in time to present the revised program to Congress by October 1957. He said the alternate plan is "based on the assumption that Mountain Sheep Dam will be one of the dams built."

Under the alternate plan, Lower Granite Dam at river mile 113.1 would have an installed capacity of 600,000 kw; Asotin, 384,000 kw; and China Gardens, 344,000 kw. The total power production of the three dams would be 1,328,000 kw—slightly higher than proposed capacity under the previous plan. Of the dams proposed, only Lower Granite has been authorized by Congress.

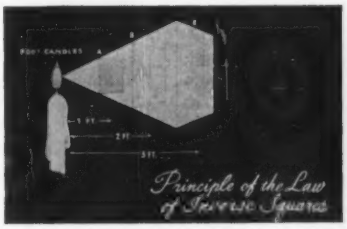
Prices Are Reduced on Low-Noise Transformers

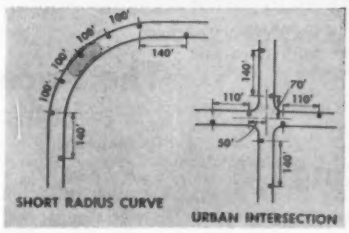
Substantial price reductions on transformers having lower-than-standard noise levels have been announced by Westinghouse Electric Corp's transformer division. Cuts apply to all power transformers above 300 kva.

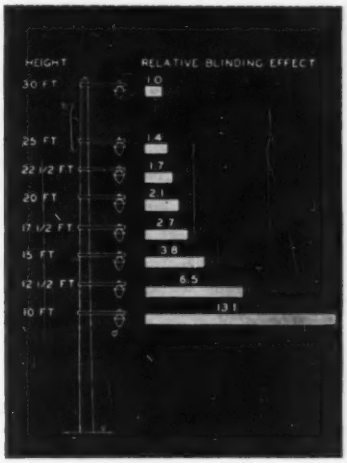
Sample reductions are: For units registering 6 db below NEMA standard of 56-60, the new premium above list is 9% compared to the old premium of 41% on list. For units registering 9 db below NEMA standard of 61-65 db, the new premium added to list is 14% compared to the former premium of 55% on list. For units registering 15 db below NEMA standard of 76-80 db, the new premium above list is 20% compared to former premium of 39%.

The move apparently caught other large transformer manufacturers by surprise. Some noted there had been price trimming in this field but none planned immediate reduction of book prices. General response was, "Of course we'll fight for our competitive position in this field."

In making the announcement, Westinghouse Transformer Manager John H. Chiles, Jr. hinted the price cuts were due to major improvements made in core steel and in fabrication of core materials.







EEI Offers Street Lighting Slides

These three illustrations are from a set of 21 slides recently prepared by Edison Electric Institute's street lighting committee. Designed for showing to civic and municipal groups, the set and an accompanying script covers light measurement and distribution, typical layouts of various traffic classifications, glare in relation to mounting height, and intersection lighting.

By including local slides of typical lighting installations or conditions, EEI suggests, utilities can complement the presentation and adapt it to various audiences. The accompanying seven-page script, which includes technical data, similarly can be changed.

The slides and script cost $16.50. Both are available on a 10-day free trial. Extra copies of the script are free. Write the Commercial department, EEI, 420 Lexington Ave, New York 17, N. Y.

THE NEWS-SCOPE

Washday at the South Pole

Washday at the South Pole—whether it be the traditional weekend ceremony or Blue Monday—should be a happier occasion for 24 young Americans of a Navy construction crew. The men will use showers, a washing machine, and a clothes dryer to keep themselves clean while building a scientific station at the pole.

An Argentine Contrast

Power rates to Argentina consumers have more than tripled since 1939 while fuel and labor costs have jumped tenfold, according to a memo addressed to Argentina's government. Various restrictions and difficulties were blamed, including expropriation of 61 powerhouses in 1944-45. Industry growth ran 7.1% a year between 1921 and 1949, but has dropped to 5% today. Now machines are so overworked that there is no reserve for emergencies or periodic overhauls.

Electronic Watchdog

Cleveland Electric Illuminating Co now boasts an "electronic watchdog" for its overhead lines. A new microwave voice-code-signal system links the utility's downtown office with four major substations and its Eastlake plant. If a line is damaged in any way, a microwave signal automatically trips circuit breakers at near-by substations. This shunts power to other lines so that repairs can begin quickly. In addition to yielding improved service to customers, the new system will obviate some equipment now required to handle line breaks, the company said.

To Probe Space Heating

An Electric Space Heating and Heat Pump Conference for electric utility companies will be held Dec. 5-6 in Barbizon-Plaza Hotel in New York City.

Sponsored by Electrical World, the conference will feature utility executives and other industry leaders who will discuss load considerations, marketing matters, and other problems of selling and serving the resistance-heating and heat-pump loads.

Among the speakers will be Edwin Vennard, vice president and managing director of Edison Electric Institute; G. W. Evans, board chairman and president, Kansas Gas & Electric Co; Vice Presidents Paul D. Brooks, American Gas & Electric Service Corp; C. M. Wallace, Georgia Power Co; Tom D. Fulford, Virginia Electric & Power Co; W. T. Richards, Indianapolis Power & Light Co; and John B. Taylor, Atlantic City Electric Co. T. O. McQuiston, Metropolitan Edison Co and chairman of EEI's Commercial Division Executive Committee, and Fischer Black, Publisher and Editor, Electrical World, will preside. Also to be featured is the first report of Electrical World's industry-wide survey of electric heating and heat pump promotion.

New Power Pool Formed

A new power pool, the outgrowth of one formed in 1927, has been established to serve the Pennsylvania-New Jersey-Maryland area. Participants include Pennsylvania Electric Co, Metropolitan Edison Co, New Jersey Power & Light Co, Jersey Central Power & Light Co, Public Service Electric & Gas Co, Philadelphia Electric Co, Pennsylvania Power & Light Co, and Baltimore Gas & Electric Co.

The tri-state interconnection covers about 48,000 sq mi, serving 5 million customers with 10-million-kw capacity. The old setup embraced Pennsylvania and New Jersey, with the first four of the utilities above participating indirectly through PSE&G. Baltimore G&E was not a member of the old power pool.

Although the four General Public Utilities Corp's subsidiaries participated indirectly heretofore, direct participation in the new setup was considered in the interest of investors and consumers. E. W. Morehouse, vice-president of GPU Corp, said various economic advantages will be obtained, such as: less spinning reserve required, diversity of demand, availability of emergency power, economy energy savings through pooled dispatching (in which most efficient plants are used to supply the pool), a staggering of new generating installations, and less risk during maintenance outages.

The Price of Politics

Utilities Director Dean Barline of Tacoma, Wash., is discovering it doesn't pay to outrank the city manager in seniority. Salaries of the two officials are tied to each other in the city's salary schedule. City Manager David Rowlands, who took the job earlier this year, still draws the starting salary of $16,800. But Barline has been on the job long enough to get a couple of step increases. His salary: $18,000.

In drawing up the '57 budget, City Council agreed the utilities director should not receive more than the city manager. Rather than raise Rowlands, it cut Barline back to $16,800.

How to Save 10% Fast

William Nordeen, manager of Douglas County PUD at Bridgeport, Wash., is convinced it pays to call for bids for transformers. Formerly the PUD bought transformers a few at a time, paying market prices. This year, it invited bids for a year's supply. Savings amounted at least to 10% on a $40,000 order.

NEWS IN BRIEF

STEAM

The growing power shortage in the Rocky Mountain and Pacific Northwest areas will be solved by the coal-rich lands of Wyoming, predicts Interior Secretary Fred A. Seaton. He said in the next 10 years only 7% of the needed 400-million kwhr can be met by hydro power and believes the limit of power from water sites will be reached soon . . . Meanwhile, Pacific Power & Light is constructing a $23-million steam plant at Glenrock, Wyo., to be used as a link in the Pacific Northwest Power Pool.

Construction has started on a new 40,000-kw step-down station in Adams County, Ind., to reinforce Indiana & Michigan Electric Co facilities in Fort Wayne Division. The plant, to be called Adams Station, is slated for Jan., 1957, completion.

First of four 60,000-kw units is under construction at San Bernardino, Calif., plant of California Electric Power Co . . . Initial unit of Long Island Lighting Co's new Edward F. Barrett Power station has gone into operation with capacity of 170,000 kw . . . Sakatchewan Power Corp plans a $40-million plant to be built in next eight years at Estevan. Dam will hold cooling water.

REA's, CO-OP's, and MUNICIPALITIES

Pend Oreille County PUD, Wash., plans to participate in Seattle City Light's construction of proposed $140-million Boundary hydroelectric dam on Pend Oreille River . . . Utilities in Oregon and Washington will be given opportunity to purchase power generated by proposed John Day Dam on Columbia River if Klickitat County PUD receives FPC construction permit, says L. E. Darland, president of PUD board of commissioners.

Two Ohio municipalities—Huron and Plain City—have sold their municipally-owned electric systems to Ohio Edison Co for purchase prices of $335,000 and $410,000 respectively. Huron had 1,350 customers, Plain City, 826.

Farm electrification in the U. S. is approaching 95%, reports Department of Agriculture. Estimates, made by REA, show electrification percentage of 94.2 as of June 30. Estimate was 93.4% the previous year.

Power Club Meet Features Plant Tour

Feature of Great Lakes Power Club's recent fall meeting was a tour to AC Spark Plug, Electronics Division of General Motors Corp, in which 70 members visited the plant. Following the tour, members met with management personnel for an open forum.

During the tour, an instrument assemblage is explained by G. W. Rudd, guide, to (left to right), D. A. Armstrong, Central Illinois Public Service Co; B. L. Hantle, Illinois Power Co; and A. E. Conzelman and C. W. Crabill, both of Central Illinois Light Co.

Technical sessions, later held in Flint, Mich., were highlighted by five talks, covering "Power Trends in Automobile Manufacturing", Harold Hardenbrook, GM; "What Automation Can Mean to the Electrification of Industry", W. W. Beardslee, General Electric; "Creativity", J. A. Anderson, GM; "The Atom at the Crossroads", J. H. Climer, Consumers Power; and "Cypak—A New Concept in Industrial Control", F. C. Fennell, Westinghouse Electric.

Changes in Capacity Reported to FPC

PLANT ADDITIONS DURING AUGUST

State	Utility	Plant	Fuel	Capacity
Calif.	San Diego Gas & Electric Co	Encina	S	100,000
Calif.	Southern California Edison Co	El Segundo	S	156,250
Fla.	Florida Power & Light Co	Palatka	S	56,470
Ill.	Heyworth Municipal Light & Power Dept	Heyworth	IC	397
Mo.	Thayer Electric Dept	Thayer	IC	1,150
Neb.	Auburn Board of Public Works	Plant No. 1	IC	2,141
Okla.	Public Service Co of Oklahoma	Sand Springs	S	1,250
Ore.	U. S. Army Engineers	McNary	H	70,000
Pa.	Chambersburg Municipal Electric Light Dept	Chambersburg	S	5,000
Vt.	Barton Electric Dept	W. Charleston	IC	1,400
Wash.	U. S. Army Engineers	Chief Joseph	H	64,000

RETIREMENTS

Colo.	San Isabel Electric Assoc, Inc	Trinidad	S	8,500
Colo.	Walsenburg Utilities	Walsen	S	3,000
Fla.	Fort Pierce Electric Dept	Fort Pierce	IC	800

U. S.	Hydro	Steam	IC	Total
Added	134,000	318,970	5,088	458,058
Retired	.....	11,500	800	12,300
Adjustments Plus	.....	30,000	400	30,400
Adjustments Minus	1,825	1,500	219	3,544
Net Change	132,175	335,970	4,469	472,614

H—Hydro, IC—Internal Combustion, S—Steam

United States Capacity as of September 1—Hydro, 25,264,919 kw; Steam, 90,362,693 kw; IC, 2,382,914 kw; Total, 118,010,526 kw.

In Housing Projects Here's . . .

How to Promote All-Electric Theme

As utilities summed up the results of tie-ins with local promotions of new homes last month, evidence mounted that dollars invested in all-electric themes are bringing in good returns.

In Little Rock, Ark., for instance, an Arkansas Power & Light Co "partnership plan" to sell electrical benefits brought these results:

- It influenced builders to install all-electric kitchens in 18 of 21 Parade of Homes projects and equip nearly all with full Housepower.
- In four years of all-electric promotions, AP&L has seen Parade homes shift from about an equal split between gas and electric kitchens to nearly 100% electric.
- An open house attendance of up to 5,000 a day during the three week campaign.

Help the Builder and His Allies

AP&L's partnership plan simply involves helping the builder and other trade allies in the promotion—without all the responsibilities of construction and display. In this year's activity the house was built and equipped for less than $20,000. AP&L's share was $1,500 plus sales promotion and publicity costs.

Basic promotion tools include these items:

1. Progress bulletins for sponsors and other interested parties.
2. A workshop conference for key sponsors well ahead of opening.
3. Progress reports to business and news editors.
4. Detailed publicity for Parade newspaper sections.

The utility and other participants got the ball rolling with a teaser campaign on the Electric-Living Home. After sponsors, trade allies, and media representatives got an early preview, a cooperative two-page ad described features and dates of the three-week open house. AP&L plugged the Parade theme on TV and radio in the first week, then featured their home for the remaining two.

"Actual revenue increase and appliance sales are hard to tabulate on this sort of promotion," said Bob Wimberly, AP&L manager of advertising and sales promotion. But "real gains can be seen" after four years of participation.

Wimberly credited the Living for Young Homemakers magazine, co-sponsors of the Electric-Living Home, for helping build interest and attendance. The publication went in with utilities in 22 other U. S. cities and reported a "tremendous response" from consumers.

Example: Only a scattering of 4,500 first-day visitors had arrived at Scottsdale, Ariz., home before it was sold completely furnished. Salt River Power District was sponsor.

Example: Attendance in Dallas, Tex., exceeded 30,000 for first four days of home showing, according to Dallas Power & Light Co.

Example: In Monroe, N. Y. (pop. 1,753) more than 5,000 visitors toured the Electric-Living Home on opening day, said Orange & Rockland Electric Co.

Photo by Thomas Airviews

ARKANSAS P&L, 22 other U. S. utilities, co-sponsored Electri-Living Homes like this with Living for Young Homemakers

FULL HOUSEPOWER, conditioning for space, sound, light, safety, climate were featured in $20,000 Little Rock home

Example: Atlantic City Electric Co. reported 10,000 persons in attendance on the first weekend.

Living magazine said all the houses sold, many of them before the formal openings. The promotion involved donation of manufacturers' equipment, staffing of homes by utility personnel, and cooperative advertising by individuals or firms taking part.

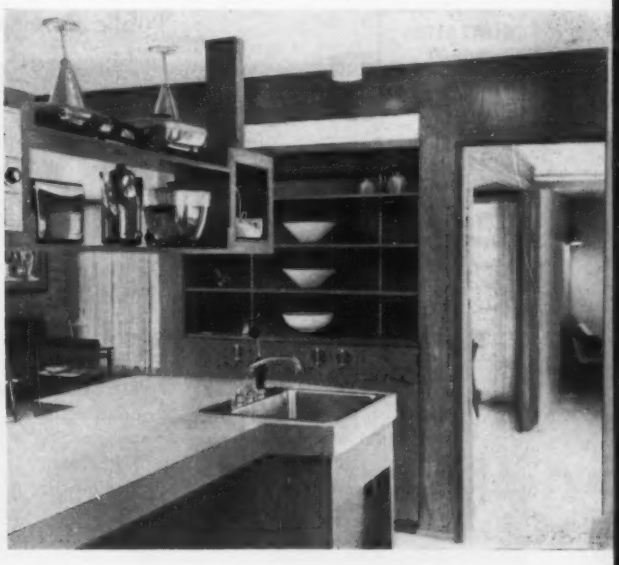
At a recent meeting of utility executives an appliance manufacturer's spokesman injected another tack on the all-electric promotion. He said, since there's "a very definite trend toward the builder 'merchandising' his home with built-in kitchens and laundries," utility management would do well to spend more to give the trend a boost.

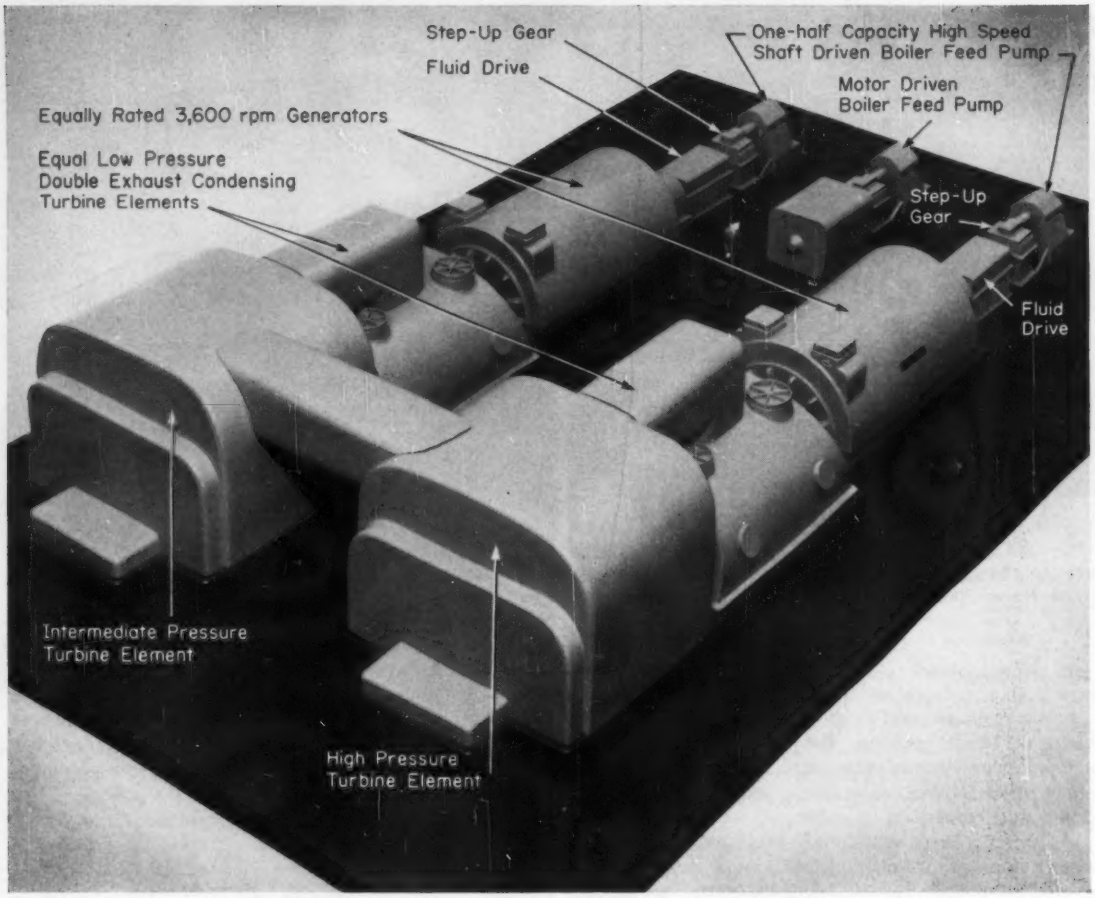
Based on current average of a million housing starts a year and the going rate of appliances sold per home, about 3.5 million appliances could be sold to this market each year, he continued. And this volume is due for an upturn in the mid-Sixties to fill population growth needs.

Utility merchandising in this field would "make it possible to sell the consumer from four to six appliances plus other items at one time, instead of the usual one or two," he said. Not only would this "sew up" consumers ahead of competition but it would be a natural for load building, improved load factor, and percent return, he said.

LIGHTING got special AP&L attention. Three-week open house dovetailed with company's fall lighting promotion

"A HOUSE OF TOMORROW built for living today—electrically" was AP&L's publicity, sales promotion theme




Step-Up Gear
Fluid Drive
One-half Capacity High Speed Shaft Driven Boiler Feed Pump
Motor Driven Boiler Feed Pump
Equally Rated 3,600 rpm Generators
Equal Low Pressure Double Exhaust Condensing Turbine Elements
Step-Up Gear
Fluid Drive
Intermediate Pressure Turbine Element
High Pressure Turbine Element

Bergen Pioneers 290-Mw Design

GENERATION
Design

Public Service E&G installs two cross-compound 2,350-psi turbines each driving two identical 3,600-rpm generators

Two 290-Mw, cross-compound quadruple-exhaust turbines, using steam at 2,350 psi, 1,100/1.050F, each driving two equally rated 3,600-rpm generators, will be pioneered by Public Service Electric & Gas Co and Westinghouse Electric Corp at Bergen (N. J.) Station. The usual low-speed (1,800 rpm) shaft has been avoided in these cross-compound machines. One half-capacity boiler feed pump will be coupled to each shaft of each unit.

Estimated station cost is $104-million, and the first unit is scheduled to operate in the summer of 1958.

Use of smaller and time-proven components in a very large turbine-generator unit promises savings in building costs. The boiler feed pump arrangement also offers economies.

Conceivably, the principles of the new arrangement are applicable to units up to and including 450 Mw although such application would probably involve a double reheater, and a sextuple flow exhaust.

Each Bergen machine will have a high-pressure element in tandem with a double-exhaust, low-pressure condensating element. This combination will be cross compounded with an intermediate-pressure element in tandem with another double-exhaust, low-pressure condensing element. Hence the machine will have a quadruple exhaust.

Steam will enter the high-pressure element and, after expanding there, will return to the reheat section of the boiler. The reheated steam will be sent back to the intermediate-pressure element on the other high-speed shaft. This element also will have a double exhaust. Steam from one of its exhaust points will then go to one of the low-pressure units, and steam from the other exhaust point to the other low-pressure element.

The two generators of each unit will split the load evenly, this equal-load split occurring at 100% capacity.

There will be only a 6% differential in load split even at capacities as low as 25%.

The arrangement will have this engineering and economic advantage: Tried and proved components can be used for all parts of the unit. The shafts of each unit will differ only in that one will have a high pressure element and the other an intermediate pressure element. Thus the utility will be able to carry common parts for both units, including items for four low-pressure elements and four generators. Generator leads and the switchgear components are the same for both units. Time and money saved by the manufacturer and utility in designing the plant will be considerable, and there should be subsequent savings in maintenance costs.

Crane Span Reduced

Reduction of building cost was an important incentive in the design's development. The two high-speed shafts of this cross-compound machine occupy less space and weigh less than the conventional, cross-compound machine, made up of one high-speed and one low-speed shaft. Even crane span will be cut about 1/6 over the conventional cross-compound arrangement. And the lighter individual units can be maneuvered by a smaller crane. Smaller and lighter units call for less costly foundations. The exhaust end blade of the new machine will be only 25 in. long, another instance of the use of tried components.

The slightly unfavorable machine heat rate (7,460 Btu per kwhr) obtainable in the smaller exhaust area of this unit compared with that of the conventional cross-compound unit is tolerable in view of the savings.

Spare Is Motor Driven

The method of providing boiler feed pump power affords still another economy. A half-capacity pump will be connected through an hydraulic coupling to each shaft of the cross-compound turbine generators, and another half-capacity spare pump will be provided for each unit. The latter will be motor driven. This arrangement is expected to save about $500,000 in first cost. This will result from the decreased outlay for motors, switchgear, and cable normally used with motor-driven boiler feed pumps. A direct drive from the turbine shaft is the most efficient means of supplying power to a boiler feed pump.

Normally, the two half-capacity pumps on each shaft will furnish the boiler feed pump requirements. The motor-driven spare will be used only for starting and emergencies. A hydraulic coupling on the shaft-driven pumps will operate efficiently throughout the entire load range of the boiler. As the motor-driven spare will be for starting and emergencies only, the original cost of an hydraulic coupling for it cannot be justified.

Having specified two high-speed shafts for these units, the designers obtained flexibility in providing the boiler feed pump power requirement. This also eliminates the high cost of equipment to provide power for motor-driven pumps. Operating experience, however, warned against having a single steam-driven boiler feed pump. But the two high-speed shafts pointed to the probability that their available power could be applied efficiently. Use of this power also permitted division of the boiler feed pump load, with its concomitant flexibility.

Auxiliary Needs Cut

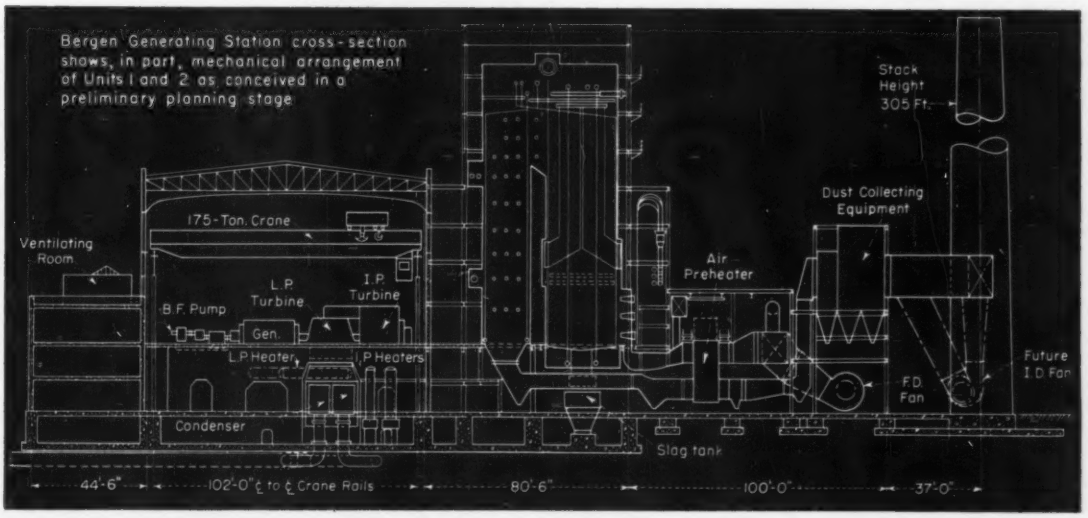
Eliminating the need for supplying auxiliary power for the all boiler feed pump capacity will greatly reduce the plant auxiliary electric power requirement. Although savings in auxiliary power needed were thus indicated, the station auxiliary power system must be adequate to meet the requirements of the motor-driven exciter and the motor-driven spare boiler feed pump.

Both boilers will have twin pressurized furnaces operating at 18 in. of water. The firing aisle will be on the boiler on the side away from the turbine generator, instead of between the boiler and turbine generator, the more conventional arrangement.

Main Stem Leads Shorter

This placement of the firing aisle made it possible to redesign the boiler so that the main steam leads will be on the side of the boiler facing the turbine instead of the top, the conventional position. This relocation of the superheater outlet will result in a considerable decrease in length of the main steam piping. Main steam piping

(*Continued on page* 241)



Blocking Scheme Protects Bus

Applied on sectionalized bus, method is independent of CT characteristics and may be left in service during switching operations. Blocking scheme is applicable for both phase and ground bus protection

O. A. LENTZ and **H. P. DUPUIS** (Deceased) Commonwealth Associates, Inc, Jackson, Mich.

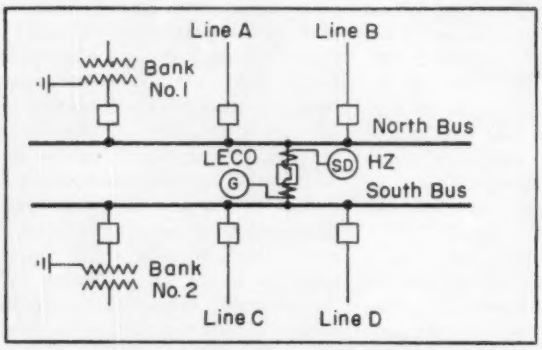


FIG 1—BUS SECTIONALIZING as used before the blocking protection was developed tripped only the bus-tie breaker

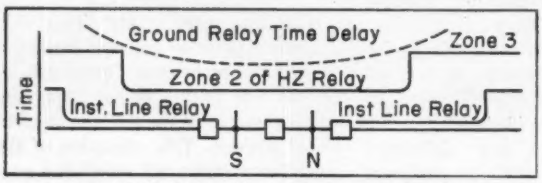


FIG 2—RELAY SCHEME without blocking doesn't insure correct operation for bus faults when station relays overlap

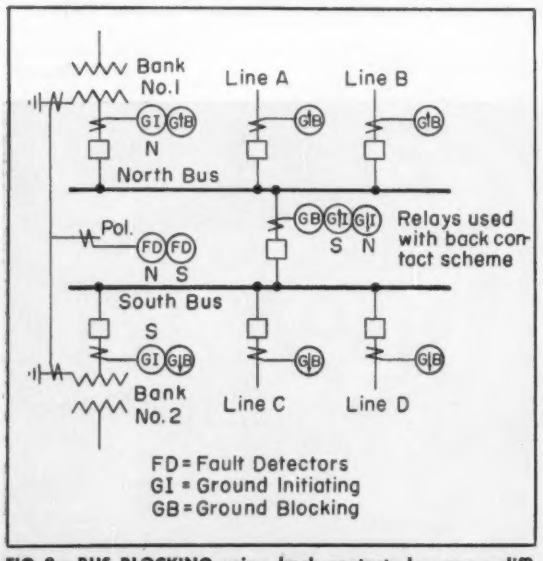


FIG 3—BUS BLOCKING using back contacts has more difficulties with contact pressure as back contacts increase

The blocking scheme of protection for a sectionalized bus is almost free of current-transformer characteristics and may be left in service during switching. For these reasons, it appears to the authors to be an excellent solution to the bus protection problem. Used for several years on 12 to 138-kv installations, it is especially applicable where bus protection is added to substations in service.

Correct operation of current-differential type of bus protection depends considerably on CT characteristics and on current transformers' not saturating for through faults. In this type of protection CT circuits must be interconnected, and usually the differential protection must be cut out during switching operations when it is most needed.

Trip circuits of a bus protection scheme may be connected to trip all breakers on the faulted bus section, including the bus tie. In an alternative scheme these circuits may be connected to trip only the bus-tie breaker, leaving the lines on the faulted bus section to be cleared by the far end relays. Tripping all breakers affords fast clearing. In the event of incorrect operation, however, it has the disadvantage of tripping several lines and probably precipitating a major interruption of the system.

Shock to System Reduced

When only the bus-tie breaker is tripped for a fault, the shock to the system is greatly reduced; and the incorrect opening of the bus tie, under normal conditions, seldom causes any disturbance. But the fault-clearing time of far-end breakers may be quite slow.

Consequently, the selection of a method of protection depends on the location of the station and the system stability limitations.

Relaying that trips only the bus tie for a bus fault has been used successfully for many years by Commonwealth Associates' client companies. This method employs an impedance relay and a low-energy induction overcurrent relay that operates for phase or ground faults on either bus section.

The impedance relay is made non-directional, and Zone 1 (as shown in Fig 2) is cut out of service. Zone 2 is set to cover an arcing fault on the bus with a reach not exceeding 50% of the shortest line. Enough time delay is used to keep the scheme selective with the instantaneous line relays, Zone 3 serving as back-up protection in the event a line breaker fails to open.

On most of these installations switching facilities permit the bus-tie breaker to serve as a transfer breaker also. A selector switch places the bus-tie relays and line sparing relays in or out of service by closing or opening their trip circuits. Tapped auxiliary CT's with the selector switch change the over-all CT ratio, depending on the switch position. This arrangement makes it possible to spare the various breakers merely by changing the selector switch to the proper position.

Today's concentrated loads have led to building substations closer together, so that sectionalizing relays cannot always be set to insure operation for bus faults without overlapping the sectionalizing relays at adjacent

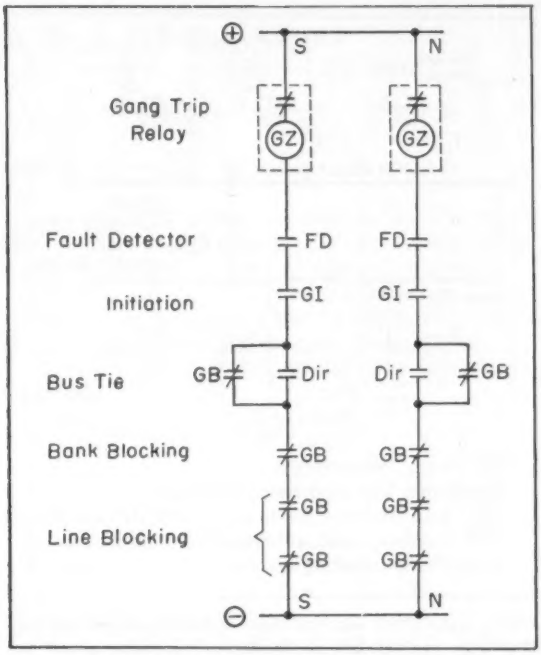


FIG 4—BACK CONTACTS are connected in series in a bus blocking relaying scheme dependent on back contact use

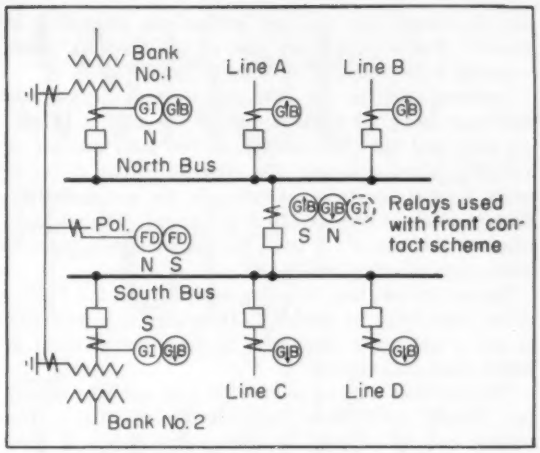


FIG 5—BUS BLOCKING in employing front contacts used two directional ground blocking relays on the bus tie

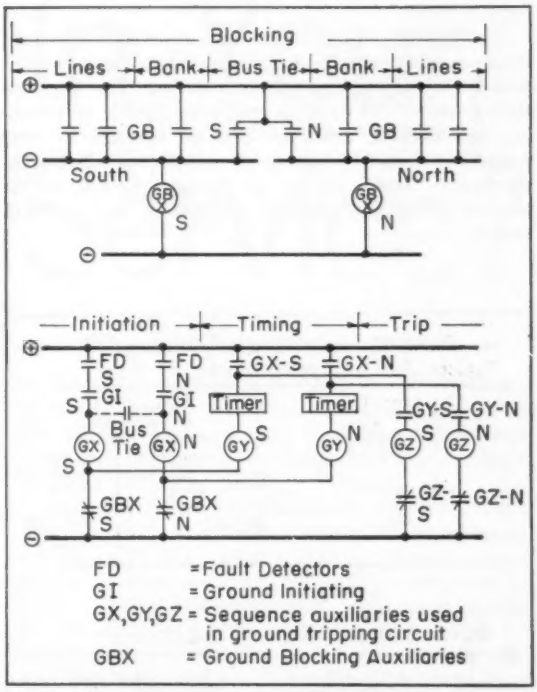


FIG 6—FRONT CONTACTS, on the other hand, are in parallel for blocking relays for all circuits on the bus section

stations. These conditions necessitated the adoption of a different type of bus protection or bus sectionalizing.

A bus blocking scheme for ground bus protection has been described by George Steeb (EW, "System Protection Analysis Precedes Oswego Design," Nov. 1, 1941, p 1413). The essential relays used (Fig 3) consist of fault-detector or initiating relays to detect ground faults on or near the bus and blocking relays to prevent tripping when the fault is external to the bus. To insure operation for bus faults under the least severe conditions, the relays must be set to operate for faults beyond the bus under the worst fault conditions.

If backfeed is sufficient to cause them to operate for a bus fault, the blocking relays must be directional. Both directional and non-directional relays are used on the bus-tie breaker, their contacts in parallel to provide initiation of the faulted bus and blocking of the unfaulted bus. Steeb's scheme used the back contacts of the blocking relays in series, as in Fig 4.

When the fault occurs on a bus section, the fault detector and initiating relays close contacts to establish the dc trip circuit through the back contacts of the blocking relays. The non-directional blocking relay on the bus-tie breaker tends to block tripping of both bus sections. By means of the parallel contacts the directional relay toward the faulted bus section bypasses the contacts of the blocking relay to initiate tripping of the faulted bus.

When the fault is near the station and on one line, the initiating relays may operate.

The blocking relay on the bus tie, however, blocks tripping of one bus section, and the line relay will open its back contact and prevent tripping of the other bus section.

It is sometimes difficult to obtain good contact pressure on high speed directional elements, this difficulty being increased by the number of back contacts in series.

Several years ago Commonwealth Associates developed a bus blocking scheme using front instead of back contacts. The relays, Fig. 5, are the same as for the back-contact scheme, only the bus-tie relays being different. Two directional ground blocking relays are used on the bus tie. If desired, a non-directional initiating relay may be used to insure initiation with one transformer out of service.

A simplified schematic diagram for this method is shown in Fig 6. The front contacts of the blocking relays

for all circuits on one bus section are connected in parallel. Operation of any one of the blocking relays energizes a dc auxiliary blocking relay, GBX.

Initiating circuits for each bus section are set up separately using the back contact of the auxiliary blocking relay and the front contacts of two fault detector or initiating relays in series. The contacts of two relays in series prevent incorrect operation in the event of accidental closing of one set of relay contacts. The initiating relay on the bus tie, if used, has its contacts connected across the initiating circuit.

Use of an auxiliary blocking relay introduces 1 or 2 cycles time delay in blocking. Therefore, it is necessary to add a few cycles time delay in the tripping circuit to insure time coordination.

The auxiliary tripping relay, GX, does not trip directly but initiates a resistance capacitor timing circuit. The resistor can be adjusted to give a time delay of from 3 to 8 cycles before picking up the auxiliary relay, GY.

Operation of GY energizes a multi-contact tripping relay, GZ. Contacts GX and GY are in series to prevent incorrect operation in event of accidental closing of the relay contacts.

Most substations have some kind of switching arrangement so that a circuit and its associated circuit breaker may be connected to either bus section. The bus protection scheme can be made completely flexible by switching the blocking and fault detector contacts to their respective circuit by means of transfer switches. Disagreement circuits are set up through contacts of the transfer switch and auxiliary contacts of the air break switch.

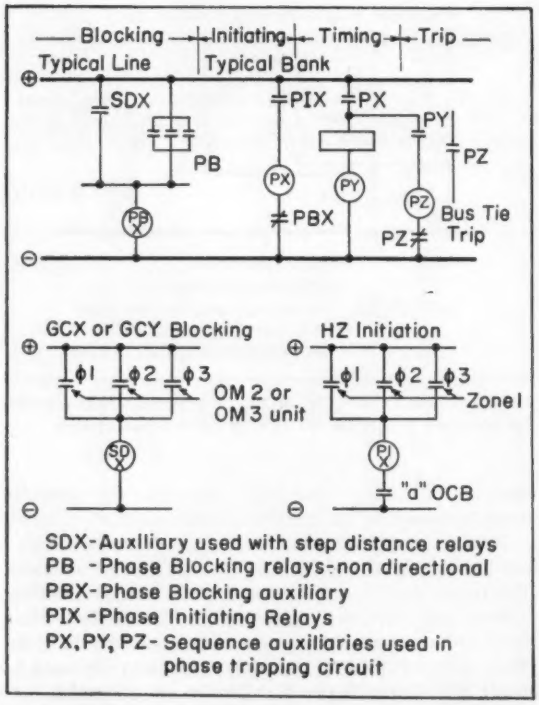


FIG 8—DIRECTIONAL ELEMENTS of one set of relays on bus tie breaker are blocked closed for phase bus protection

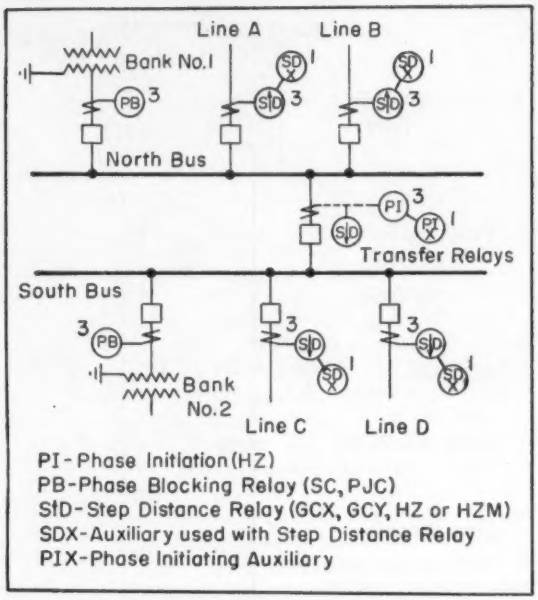


FIG 7—BLOCKING has also been applied to phase bus protection to trip the bus tie breaker on a sectionalized bus

It is possible to have ground protection at substations where there is no local source of ground current. For such an installation fault detector relays may consist of directional ground relays in two or three lines that are dependable sources of ground current, with the additional precaution of using a zero-sequence overvoltage relay for initiation. Settings of the fault detector and blocking relays must be checked to insure that the blocking relays have positive operation for any possible condition that will operate the fault detectors.

The blocking principle has also been applied to phase bus protection to trip the bus-tie breaker on a sectionalized bus, Figs 7 and 8. One set of HZ relays with the directional elements blocked closed is used on the bus-tie breaker. The Zone 1 element of the HZ relays operates for phase faults on or near the bus to initiate an auxiliary relay, PIX. Closing of the PIX contacts energizes the PX auxiliary which initiates the tripping sequence.

After the time delay the bus tie breaker trips unless it is blocked. Connecting lines to the bus have GCK, GCY, HZ, or HZM relays. Auxiliary blocking relays, SDX, are actuated instantaneously for external faults by the starting unit, the Zone 2 or 3 elements of the step type relays. Operation of the auxiliary relays for an external fault energizes the phase blocking auxiliary, PBX, which opens its back contacts in the PX circuit. This de-energizes PX and stops the tripping sequence.

On radial lines and on transformer banks, unless there is a very heavy infeed, it is possible to use three plunger type relays for blocking.

All installations of phase bus blocking to date have provided only for tripping the bus tie breaker. But the scheme could easily be expanded to trip all breakers on a bus section by using two directional distance relays on the bus-tie breaker and having two independent tripping circuits similar to those for ground protection.

A Special Report

What Puts Quality In Your Service?

LEONARD M. OLMSTED, Managing Technical Editor

More intensively than at any other period in nearly two decades electric utilities are scrutinizing the quality of their service. They recognize that customers will not fully accept electrical living until they are completely satisfied to commit their comfort, safety, and earning ability to the electric service they get.

What puts quality in this service? Five important ingredients are:

1. Capacity to serve all demands.
2. Voltage within acceptable limits.
3. Frequency of sustained accuracy.
4. Continuity to avoid discomfort and production losses.
5. Competent, courteous personnel.

System capacity is a manpower and cost problem today. But engineers know how to provide it, and deficiencies are seldom serious.

Voltage likewise seems to be under control. There are cases, such as automated equipment in modern factories, which call for extremely close tolerances. But practices generally seem to follow the EEI-NEMA finding that 110 to 125 v at the lamp or appliance is "favorable". And even REA has urged rural co-ops to provide voltage within the EEI-NEMA "tolerable zone" of 107-127.

Frequency acquires new significance with its use for timing industrial operations. No longer is it enough to "put the clocks back right before quitting time." But expanding interconnections and the close tolerances of their tie-line controls and economic dispatch have done much to reduce frequency variations.

Continuity, however, is a different situation. Is it measured in interruptions per customer per year? Or is it cumulative outage time? Should the brief intervals between instantaneous tripping and successful reclosure of a circuit breaker be counted? Such questions confuse the collecting of performance data. Without such data the distribution engineer has little to guide his efforts to design for service continuity. But despite this confusion a few progressive utilities have set up tentative design criteria and practices to guard against inferior service.

Competent, courteous personnel have less direct bearing upon the service quality. But they contribute heavily to the customers faith in it. And these personnel will have an important part to play in determining how nearly perfect service needs to be. Here the customer is a poor judge, for long experience and unrealistic publicity have taught him to be critical of all service interruptions.

Since their Trends in Distribution survey of 1954 revealed 10 utilities and 3 co-ops claiming design criteria for service continuity, Electrical World's editors have explored service quality with utilities from coast to coast. Almost everywhere they found new interest in various facets of the problem, ranging from an assault on service interruptions to the recording of voltage and loads to guide distribution planning. From these explorations they have selected the five articles on the following 15 pages for a progress report on service quality.

In This Report:

2 Practices Aid Distribution Reliability . . . . . Page 118
Seeking Good Service Standards . . . . . Page 120
"Gold Plating" Stops Power Outages . . . . . Page 125
Pole-Top Graphies Boost Accuracy . . . . . Page 128
Surveys Transformer Loading . . . . . Page 130

2 Practices Aid Distribution Reliability

Reinforcements are built before load requires them. Load on portion of interrupted feeder is switched for quicker pickup

R. E. REINBOLD, Supervisor, Electrical Engineering, Arizona Public Service Co, Phoenix, Ariz.

Reliability of distribution systems operated by Arizona Public Service Co has been improved by application of two practices:

1. Constructing system reinforcements before they are required for load growth.

2. Switching portions of an interrupted feeder's load to adjacent feeders for rapid pickup.

The first practice aims to prevent or reduce the number of outages; the second, to reduce the duration of outages. Each contributes to a higher degree of service reliability.

At present, any discussion of means to obtain greater reliability is handicapped by lack of an accepted standard of reliability. This lack makes it difficult to report exactly the improvement following the application of the above practices. Justification for them comes from the fact that subsequent outages are fewer or shorter than before. This improvement in service can be substantiated in part by a review of the operating record.

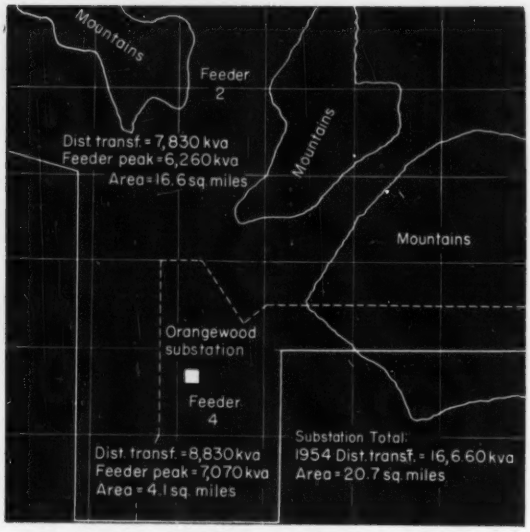


FIG 1—WHEN TWO FEEDER AREAS were served from Orangewood sub, each 12-kv feeder had many exposed miles

Final justification must lie in the conditions on the part of the system under consideration, needs of the operating department, and desires of management. As these vary on a particular system, and even more widely between different utilities, only general rules can be laid down.

Arizona PS appplies the two practices primarily for greater reliability. In applying the concept of construction

SUBSTATION ORANGEWOOD
DISTRICT Phoenix
TRANSMISSION LINE — KV
FEEDER # 2 12 KV

DATE & TIME	TOTAL AREA AFFECTED: AREA	TOTAL AREA AFFECTED: LOAD LOSS KW-MIN	DAMAGE DONE	NATURAL CAUSE: OVER-LOAD	NATURAL CAUSE: Lightning	NATURAL CAUSE: Wind	NATURAL CAUSE: Snow - Sleet	NATURAL CAUSE: Tree	NATURAL CAUSE: Animal	NATURAL CAUSE: Other	MAN-MADE CAUSE: Pole - Guy	MAN-MADE CAUSE: Plane - Tree	MAN-MADE CAUSE: Crane - Rig	MAN-MADE CAUSE: Planned	MAN-MADE CAUSE: Other	EQUIPMENT FAILURE CAUSE: Conductor	EQUIPMENT FAILURE CAUSE: Connector	EQUIPMENT FAILURE CAUSE: Insulator	EQUIPMENT FAILURE CAUSE: Transformer	EQUIPMENT FAILURE CAUSE: Other	Cause Unknown	PROTECTION: RELAYING: Correct	PROTECTION: RELAYING: False	PROTECTION: RELAYING: Failure	PROTECTION: SERV. RESTORED	PROTECTION: FUSES	REMARKS
5-16-56 5:04 PM to 5:04½ PM	Orangewood Feeder # 2 Area												X									X					Crane faulted primary phase together at 3rd. Ave. & Marlett
6-28-56 8:05 PM to 8:18 PM	Orangewood Feeder #2 Area					X																X					Primary burned down in es. R/o Pomona & W/o 3rd. St.
7-8-56 6:16 PM to 6:22 PM	Orangewood Feeder # 2 Area										X											X					Guy knocked down by car at 3/p/4/o Central on Glendale Ave.
7-12-56 1:57 PM to 2:08 PM	Orangewood Feeder # 2 Area											X										X					Tree trimmers dropped limb into line at 3rd. & Northview
8-17-56 11:16 PM to 11:34 PM	Orangewood Feeder # 2 Area				X	X																X					Primary wrapped together at Central and Camelback

FIG 4—TROUBLE RECORD FORM used by Arizona Public Service will provide basic data from which a study can be made of outages. Study will analyze outages caused by equipment failures and type of construction for distribution lines

Mountains
Feeder 4
Dist. Transf. = 3,860 kva
1954 Feeder peak = 3,090 kva
1956 Feeder peak = 4,680 kva
Area = 11.8 sq. miles
Mountains
Feeder 3
Dist. Transf. = 1,440 kva
1954 Feeder peak = 1,150 kva
1956 Feeder peak = 5,710 kva
Area = 4.1 sq. miles
Mountains
Feeder 2
Dist. Transf. = 7,500 kva
1954 Feeder peak = 6,000 kva
1956 Feeder peak = 8,150 kva
Area = 2.8 sq. mi.
Orangewood substation
Substation Total:
1954 Dist. Transf. = 16,660 kva
1956 Dist. Transf. = 32,500 kva
Feeder 1
Dist. Transf. = 3,860 kva
1954 Feeder peak = 3,090 kva
1956 Feeder peak = 7,440 kva
Area = 2 sq. miles

FIG 2—WHEN FOUR FEEDER AREAS were established, exposure was greatly reduced, and trouble was easier to locate

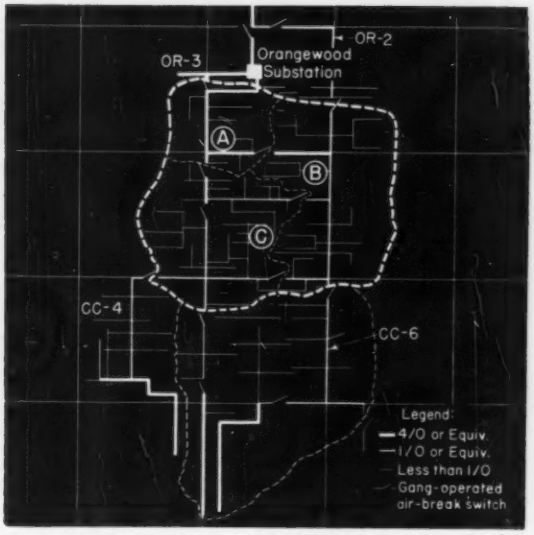


FIG 3—NOW SWITCHES AND FEEDER TIES allow load in area OR-1 to be cut over when necessary to adjacent feeders

in advance of need from a load growth standpoint, there are these considerations. Estimated load growth in the area being considered must be such as to justify fixed charges on new construction within a few years. Importance of the area must be judged on the basis of effect outages will have on customer goodwill. The construction must include new lines or line extensions which will speed up location of trouble so as to reduce outage time. The total of these considerations will determine whether a greater degree of reliability would be desirable and whether the new construction will provide it.

In using new construction as a means to greater reliability, total load in a particular area is divided into equal or nearly-equal portions. Load based on estimated growth for at least two years, and not present load, should be used in arriving at total load and the load in each portion. Then existing feeders are rearranged and new feeders are laid out to serve the load in each portion.

New construction in the area served by the Orangewood Substation is an example of this practice. As shown in Fig. 1, the area in 1954 consisted of two comparatively large portions, each served by a 12-kv feeder. Load on feeder 2 was 6,260 kva and on feeder 4 was 7,070 kva. Each had many miles of line exposure. Outage rate from operating records indicated some action was needed. Analysis of these records showed that outages due to storms and trees predominated over those from equipment.

Based on the considerations governing new construction to increase reliability, the decision was made to add two feeders and divide the load as shown in Fig. 2. Load breakdown at that time in kva per feeder then became: No. 1, 3,090; No. 2, 6,000; No. 3, 1,150; No. 4, 3,090.

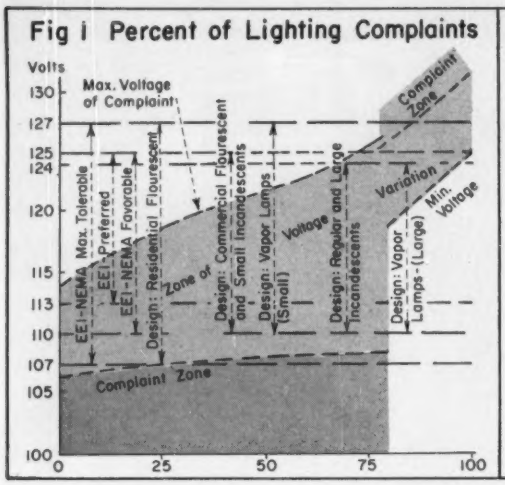
Line exposure roughly was halved by the two new feeders. Customers affected by a feeder outage were reduced correspondingly. And outage time could be reduced because it became easier to locate and isolate the trouble.

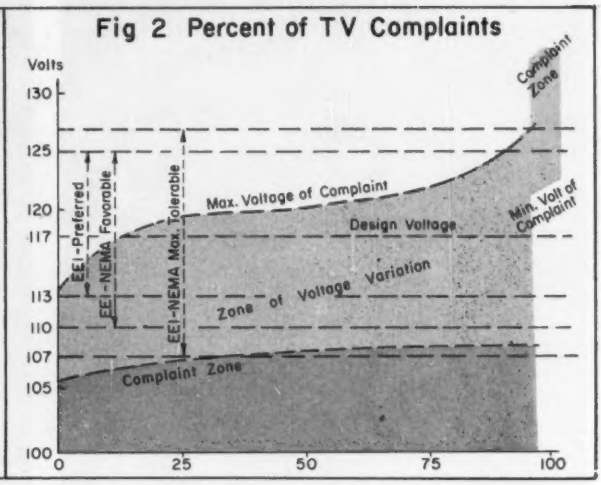
The second practice, switching to reduce outage time, follows naturally after the first. In applying switching equipment and lines as a means to greater reliability, there are these considerations. Switching equipment and heavier lines between feeder areas may be added when new feeders are being built or when existing feeders are being rebuilt or cutover to a higher voltage. In established load areas, switches and heavier lines are added on the basis of trouble experienced there.

The general approach is to analyze the area to determine where switches will be located, what lines will need heavier conductors, and where switching ties will be located. The load on each feeder is broken down into three or four equal or nearly-equal parts. Gang-operated air break disconnect switches are provided so that each part may be transferred to another source. The preferred source is a feeder from another substation although in some cases it is necessary to transfer the load to a feeder from the same substation. Feeders and feeder ties are designed with sufficient capacity to carry this 25-33% greater load during the outage period.

This practice is illustrated in Fig 3. Switching and feeder ties are provided so that the load served by Orangewood Substation Feeder 1 may be transferred in three nearly equal parts, A, B, and C, to feeders designated OR-2, OR-3, CC 4, and CC-6. For interconnections within a feeder area and to adjacent feeder areas, the manually controlled air break switch has been found least expensive. In areas where this practice is used, substations are all on supervisory control without automatic reclosing equipment. Crews are dispatched and remain in contact with the load dispatcher by mobile radio. Coordination of switch operation at sectionalizing points with operation of substation breakers by the dispatcher is accomplished easily.

As effective as the above practices are in providing greater reliability, there still remains a need for a standard of reliable service. To this end, Arizona PS records outages on substations, transmission lines, and distribution circuits. The form used is shown in Fig. 4. This trouble record provides the basic information for a study of the causes and lengths of outages. This study will include analysis of outages caused by failures of equipment and distribution lines, and explore the possibility of reducing outage time with improved operating methods. It is hoped that studies of this type will lead to formation of a reliability standard.





Seeking Good Service Standards

Alabama Power Co is studying voltage regulation, service continuity, flicker, also state laws and customer complaints

L. B. MURRAY, Supt of Transmission
O. R. ST. JOHN, Senior Engineer
Alabama Power Co, Birmingham, Ala.

Standards for voltage regulation, service continuity, and flicker are being sought by Alabama Power Co in a yet uncompleted study of what constitutes service acceptable to customers and is in agreement with legal requirements. The standards would enable a utility to expand economically without encountering the complaints of customers, determine practices and equipment, and permit the budgeting of expenditures to keep them within the money available from the revenue expected from plant investment. So far the studies have produced the following information:

Alabama Power appears to be close to establishing a standard for voltage regulation based on laws laid down by government agencies, committee recommendations, complaints received, and actual practices.

A recent survey of state public service commissions revealed that legal requirements for voltage variation at customers' premises vary considerably. Variations in the legal re-

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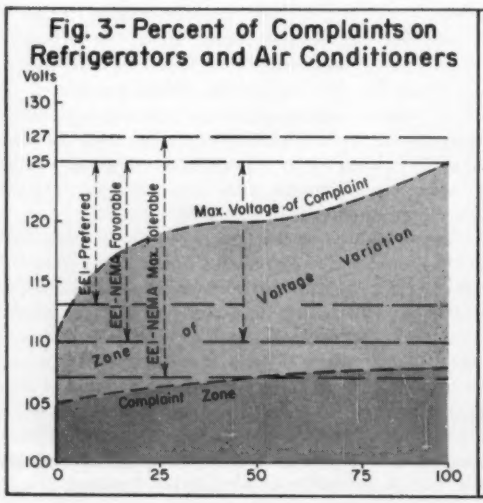
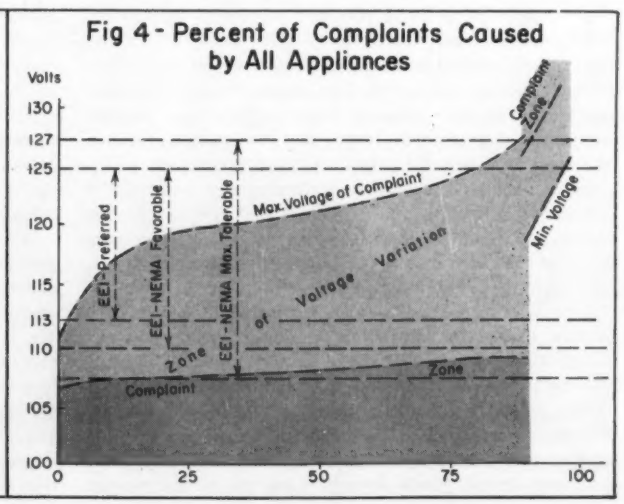
Adapted from a paper presented at the Southeastern Electric Exchange Engineering & Operation Section, Augusta, Ga.





quirements are shown in Table I. Some states have requirements covering population dividing lines, maximum allowable regulation, maximum variation above and below nominal voltage, and the hours of the day during which their regulations apply. Others require compliance with only several of these requirements. A few do not control service quality.

The only uniform requirement revealed by the survey was a 10% variation allowed for voltage delivered to power customers, and this applied only in states where the commissions exercised control. But, even with these differences among states, commissions accomplish the goal of uniformity of service in their jurisdictions.

Table I—State Requirements on Voltage Regulation

No. of States*	City Populations	Max. Regulation Allowable—%	Max. Variation from Nominal—% Above	Below	Time Limit
4	> 2,500	6	5	5	Lighting Hours
	< 2,500	8	5	5	Lighting Hours
1	> 1,500	6	5	5	None
	< 1,500	8	5	5	None
1	> 2,000		5	3	None
	< 2,000		7	5	None
1	>15,000	8	5	5	None
	<15,000	12	8	8	None
1	> 500	8			8 AM—Midnight
1	< 500	12–14			8 AM—Midnight
4	None		5	5	None
2	None		6	6	None
1	None		<8	<8	None
3	None		5	3	None
1	None		3	5	Sunset—11 PM
	None	15			11 PM—Sunset
1	None	6	5	5	None
1	None	10	5	5	None

*Some states do not control service requirements

EEI-NEMA Voltages Good

In the past the industry almost adopted voltage-regulation standards although they were left as committee recommendations. The EEI-NEMA committee recommended a favorable zone of 110-125 v and a maximum tolerable zone of 107-125 v. EEI has recommended a preferred voltage of 113-125v. This preferred voltage would undoubtedly be good—as well as expensive.

Yet can the industry do with less?

The answer to this lies in the ratings of appliances and equipment, which have little uniformity. Related to ratings, but of possible greater importance, are customer complaints.

Records Show Complaint Area

A summary of lighting complaints received by Alabama Power is shown in Fig 1, along with EEI-NEMA recommendations. The lower line of the voltage-variation zone represents where complaints begin to occur. The upper line is the usual corresponding top voltage of the complaint. For example, about 25% of lighting complaints had a top voltage of 118 v or less, and complaints began to be received at 107 v.

About 23% of lighting complaints were due to high voltage. But 56% were within the tolerable zone. This indicates that the tolerable zone is not such for lighting customers unless utilities are willing to live with complaints.

Complaints due to television are about equal to those from lighting. Fig 2 shows that about 55% of TV complaints are within the tolerable zone. Fig 3 shows complaints for refrigerators and air conditioners, none of which cited high voltage. There seems to be a wider voltage variation allowable on these appliances than on others.

A summary of complaints is shown in Fig 4. About 60% fell within the EEI-NEMA tolerable zone. To minimize the complaints, voltage must be kept above the 107-v limit. Apparently, this was set to allow for a certain percentage of complaints.

Standards should be set up for continuity of service as it is daily becoming more of a problem. The modern home is run by electricity. An interruption in service stops everything; water can't be heated, the furnace won't work, the range can't cook, etc. In rural areas homes suffer even greater inconveniences.

Utilities today serve industrial

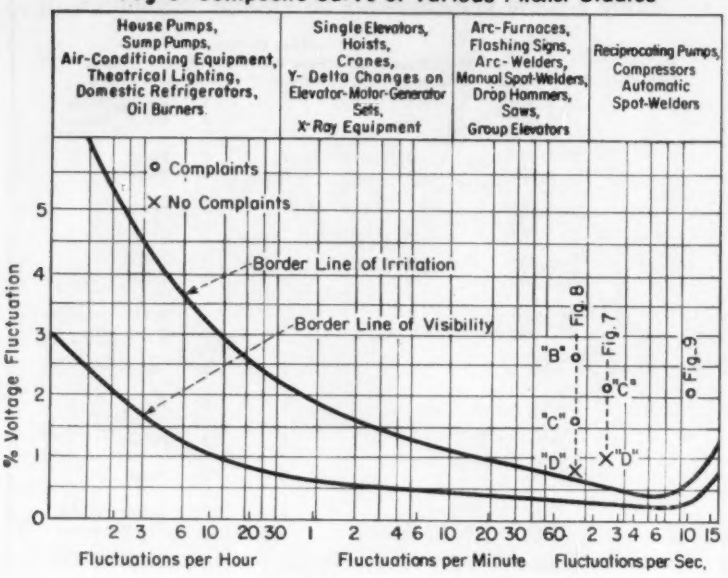
Table II—Outage Records for 13 Towns

Yearly Averages of a Number of Years

Population of Town	Type of Load	Instantaneous Interruptions	No. of Outages	Outages Per Year
3,000	Industrial, commercial, rural	6.6	1.3	1 hr 50 min
5,157	Industrial, commercial, rural	12.6	2.3	1 hr 40 min
670	Commercial, rural	4.6	1.3	1 hr 36 min
1,153	Commercial, rural	12.3	1.0	2 hr 17 min
500	Rural	12.3	3.3	6 hr 40 min (Tornado)
1,000	Commercial, rural	5.0	3.3	7 hr 46 min (Tornado)
2,000	Commercial, rural	2.3	0	1/3 min
*1,250	Commercial, rural	9.0	1.3	2 hr 48 min
910	Commercial, rural	4.0	1.3	2 hr 22 min
*1,765	Commercial, rural	5.6	4.3	6 hr 57 min
*3,102	Commercial, rural	4.6	2.1	4 hr 49 min
*3,162	Commercial, rural	12.1	2.0	2 hr 3 min
533	Rural	27.0	3.1	8 hr 5 min

*Complaints were received on these service records, either by the town governing body or a group of customers.

Fig 5-Composite Curve of Various Flicker Studies


House Pumps, Sump Pumps, Air-Conditioning Equipment, Theatrical Lighting, Domestic Refrigerators, Oil Burners
Single Elevators, Hoists, Cranes, Y- Delta Changes on Elevator-Motor-Generator Sets, X-Ray Equipment
Arc-Furnaces, Flashing Signs, Arc-Welders, Manual Spot-Welders, Drop Hammers, Saws, Group Elevators
Reciprocating Pumps, Compressors Automatic Spot-Welders
o Complaints
× No Complaints
Border Line of Irritation
Border Line of Visibility
Fig. 8
Fig. 7
Fig. 9
"B"
"C"
"D"
% Voltage Fluctuation
0
1
2
3
4
5
2 3 6 10 20 30 1 2 4 6 10 20 30 60 2 3 4 6 10 15
Fluctuations per Hour
Fluctuations per Minute
Fluctuations per Sec.

plants that previously generated their own power. These customers demand almost uninterrupted service. Some have said that they can stand a 30% dip in voltage when it lasts less than 30 cycles. These requirements have been met through installation of flip-flop switches operating in 18 cycles to switch to alternate feeds. But cotton mills are shut down by the instantaneous opening and closing of a circuit breaker which breaks the threads in looms.

Unless customers with continuous flow processes receive high-grade service, they will start generating again. Usually these very high-load-factor loads justify the cost of providing ultra-high quality service.

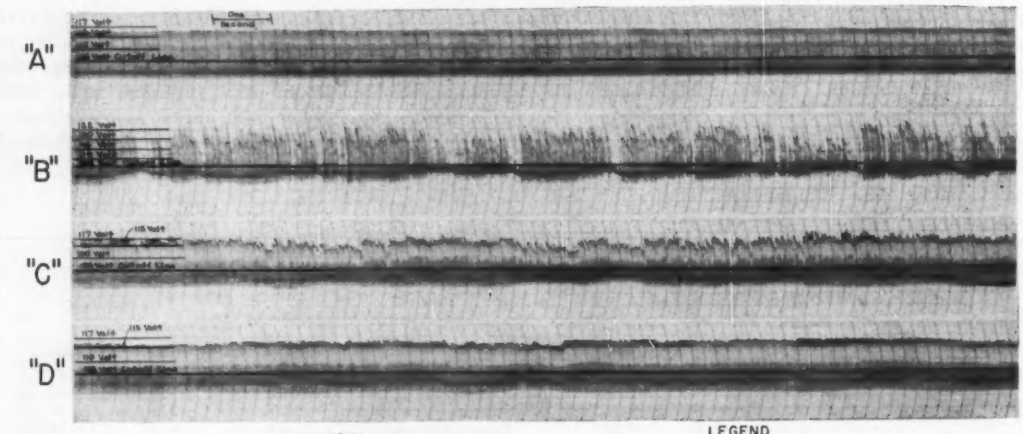
Customers Expect Continuity

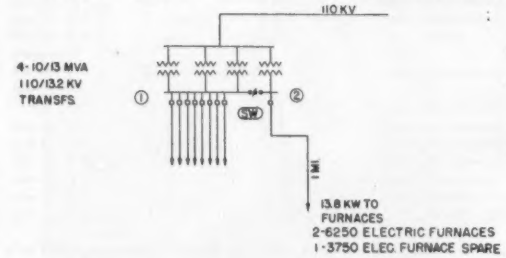
Thus all utility customers expect and receive better continuity. Yet small outages are causing complaints that would not have been heard a few years past. This is true in the larger populated areas as well as the small towns.

Service records for 13 small towns are shown in Table II. All have some rural load, a few have industrial load, and most have commercial load. The records appear generally satisfactory, except for one or two longer outages caused by a tornado which did not actually result in complaints.

Table II shows that small town customers complain when total outage time per year is 2 hr or more. This figure is not being recommended as a minimum standard because a stand-

FIG 6 – FLICKER TESTS – RED MOUNTAIN SUBSTATION





LEGEND

CHART "A" – FLICKERMETER AT ①, SW OPEN, NO FURNACE LOAD.

CHART "B" – FLICKERMETER AT ②, SW OPEN, FURNACE LOAD 7-12 MW.

CHART "C" – FLICKERMETER AT ①, SW CLOSED, FURNACE LOAD 12-15 MW.

CHART "D" – FLICKERMETER AT ①, SW OPEN, FURNACE LOAD 10-16 MW.

NOTE: WITH SW OPEN- SHT. CCT. CURRENT AT ② = 121 MVA
SHT. CCT. CURRENT AT ① = 318 MVA
WITH SW CLOSED- SHT. CCT. CURRENT AT ①&② = 400 MVA

ard should be consistent with economics. But the record indicates what this customer expects.

A standard for service continuity could be developed that would let the customer know what to expect and still be within economical limits. Such a standard would assist both the utility and consumer in their mutual aims.

Flicker Standard Needed

Standards for flicker are desirable. They should apply when electric furnaces and motors, started fully loaded, are added to systems. If flicker is not analyzed thoroughly before the customer is served, expensive corrective measures must be made.

Flicker has two basic components: The magnitude of the voltage dip, and the frequency with which the dip occurs. These relationships are shown in Fig 5, reproduced from the GE Distribution Data Book. Alabama Power generally has followed these curves to maintain fairly satisfactory voltage.

But complaints have been received when conditions were satisfactory as calculated according to Fig. 5. In other cases these calculations have indicated voltage conditions that should have caused complaints but didn't. So some doubt exists as to the satisfactory limits that will not impose hardship or inconvenience on customers or cause serious complaints.

Moreover, such standards are needed to help determine when to stop spending money for correction. Of course, flicker should be reduced to a satisfactory level. But what is satisfactory? And if a border line case is left, the condition must be overcorrected to satisfy the customer.

Develop Flickermeter

In an effort to determine standards for flicker the company developed a special recording meter, shown in the photo. It is hoped that a study of records accumulated through the use of this meter will lead to the establishment of satisfactory limits.

The flickermeter records voltage peaks of each cycle, with sufficient accuracy that very small variations can be noted, counted, and reduced to the general form required for plotting in Fig. 5. These records are obtained through the use of a voltage clipper and dc amplifier, so only the top 10% of the sine wave is recorded, to magnify small deflections.

Records obtained from use of the flickermeter are shown in Figs 7, 8, and 9; corresponding dips and frequencies in Fig 5.

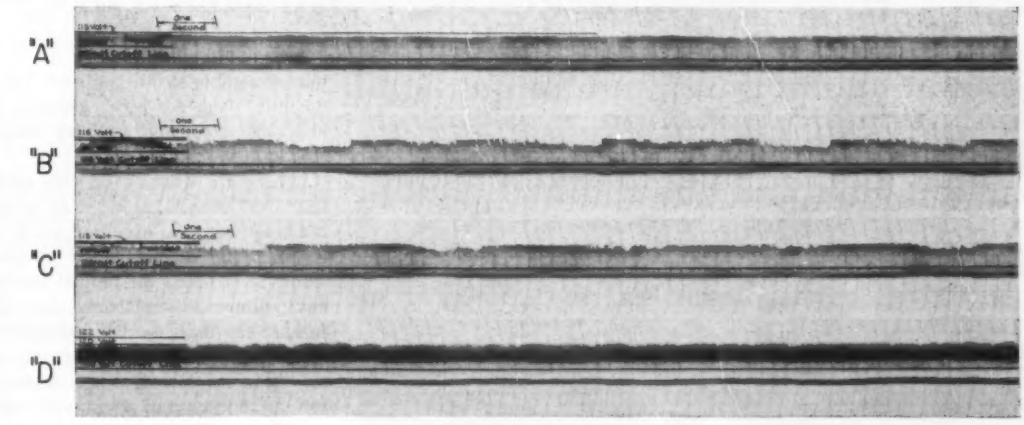
Fig 7 shows the flicker caused by an electric furnace. Trace "D" is the corrected flicker. This seems high compared with curves in Fig 5, although complaints have not resulted. This is also true of corrections in Trace "D" of Fig 8.

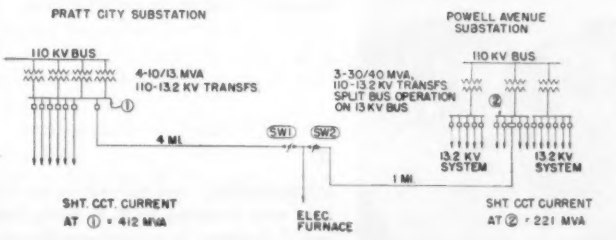
Use of the flickermeter solved a difficult problem at a gravel company, illustrated in Fig 9. Complaints were received after a dragline went into operation. It was first thought that a separate substation would be required, but use of the flickermeter showed the troublemaker to be a new dredge pump motor, installed about the same time as the dragline. The motor had unbalanced currents in its rotor windings.

Check System for Flicker

Flicker tests are being made on the system wherever trouble is believed to exist. Checks are made to deter-

FIG 7—FLICKER TESTS—PRATT CITY & POWELL AVE. SUBSTATIONS





LEGEND

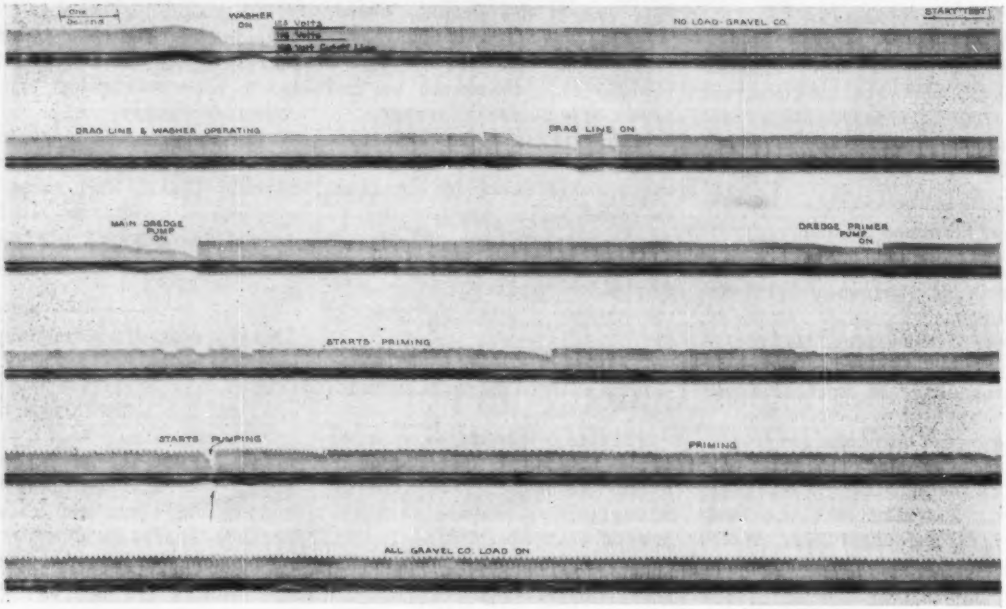
CHART "A" - FLICKERMETER AT ②, WITH SW1 OPEN, SW2 CLOSED, & NO LOAD ON ELEC. FURNACE.

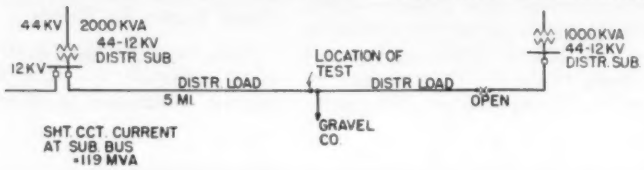
CHART "B" - FLICKERMETER AT ②, WITH SW1 OPEN, SW2 CLOSED, & 1-3 MVA ELEC. FURNACE LOAD.

CHART "C" - FLICKERMETER AT ②, WITH SW1 CLOSED, SW2 CLOSED, & 1-3 MVA ELEC. FURNACE LOAD.

CHART "D" - FLICKERMETER AT ①, WITH SW1 CLOSED, SW2 OPEN, & 1-3 MVA ELEC. FURNACE LOAD.

FIG 8 – FLICKER TESTS- SAND AND GRAVEL CO.





GRAVEL CO EQUIPMENT

WASHER: WATER PUMP-100 HP
CONVEYER - 25 HP
TWO SMALL CONVEYERS-5HP EA
LARGE SCREEN-25 HP
SMALL SCREEN- 5 HP

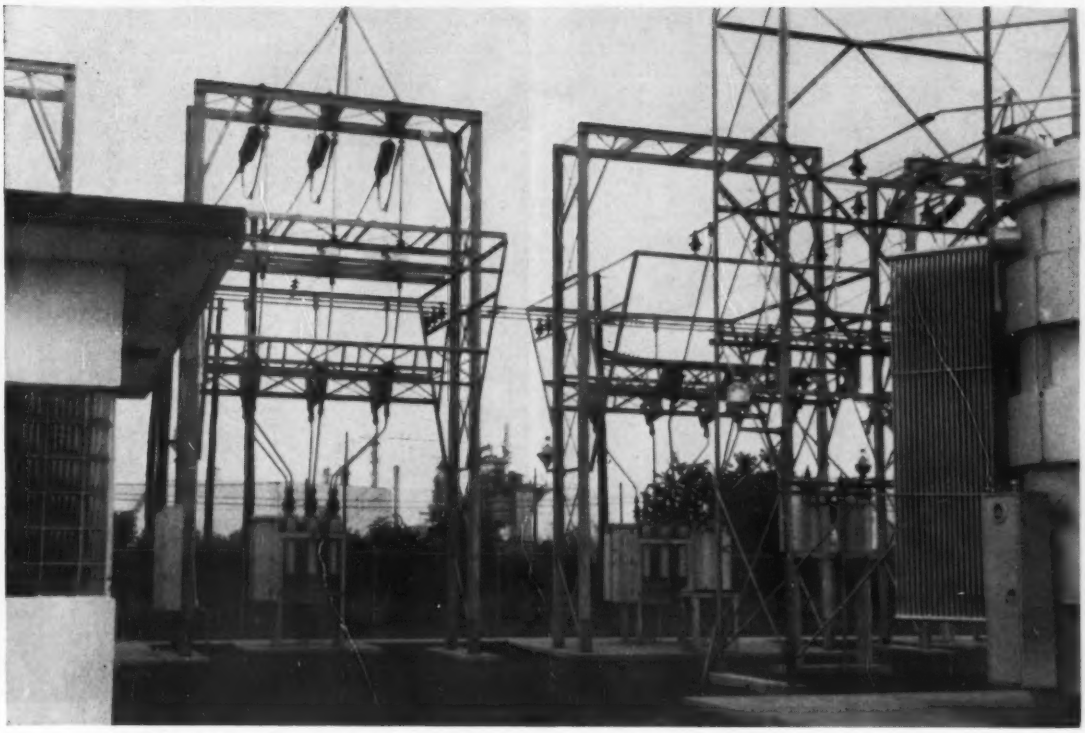
DREDGE: MAIN PUMP-400 HP
PRIMER PUMP-30 HP
PUMP HOIST - 30HP
SPUD HOIST - 20 HP

DRAG LINE: 125 HP MOTOR

FLICKERMETER, used for testing on system, was designed by C. H. Early (left) and C. D. Lucas Jr, of Alabama Power's Central Testing Laboratory

mine if complaints are received. Little by little, data, are being gathered to help the company establish standards.

Others are working on this problem also. An AIEE working group came up with an excellent guide to be used in designing for furnace loads. It is based on mutual impedance, using the impedance from the furnace tap back through the system, and is, in effect, the inverse ratio of the fault current. But arc furnaces are just one type of equipment causing flicker. Satisfactory limits must be established to cover all causes.



FIVE 13.8-KV FEEDER BREAKERS are tapped to two bus sections having a tie breaker. Power transformer is shown at the right, relay and control house at the left, and a 13.8-kv shielded feeder in the background toward the refinery

"Gold Plating" Stops Power Outages

Louisiana Power & Light Co uses a number of substation and transformer schemes to meet requirements of continuous-flow process industries

H. L. DELONEY, Assistant Chief Engineer, Louisiana Power & Light Co, New Orleans, La.

"Gold-plated" facilities for serving industries having continuous flow processes prevents outages that force costly shut downs and loss of process material. They also help to protect plant and personnel against hazards of fires and explosions. This gold plating, Louisiana Power & Light has found, costs 10 to 15% extra but is justified by the revenue from high load-factor usage.

Arrangements of facilities for supplying this gold-plated service have certain features in common. There are always two or more generating stations or sources connected through two or more shielded circuits (usually transmission), through substations, etc, to the customer's bus. Other features may vary widely because of load size and location of the customer's plant with respect to existing generating stations, substations, and transmission and distribution lines. But proper relaying of both the utility's and customer's equipment is vital to satisfactory operation.

Shielding of transmission lines, both new and old, is important in assuring gold-plated service. LP&L has perfected the system so that permanent damage from lightning is almost completely eliminated. Momentary transmission outages have been reduced to a very low percentage.

Shielding of important distribution circuits can be just as effective when properly applied. And it is recommended for open-type lines owned by the customer. But just placing an overhead ground wire on a circuit does not necessarily constitute a satisfactory lightning-proof circuit. Impulse insulation, air gap clearances, and tower footing grounding impedances must be coordinated to assure proper performance.

One of the most common arrangements for supplying multiple-source service is the automatic-transfer, called "flip flop." For this two sources are supplied, one being the normal source and the other the emergency feed. In some cases, called "split feed", one circuit supplies part of the load and the other the remainder.

Fig 1 shows an automatic-transfer arrangement. When a circuit is re-

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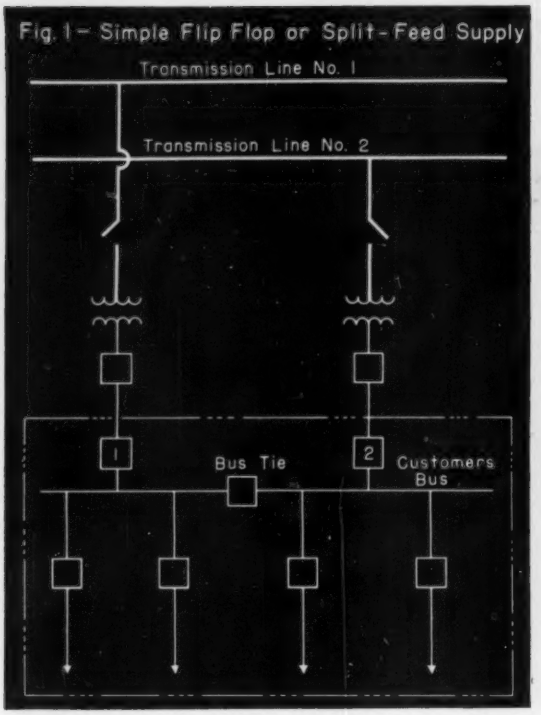
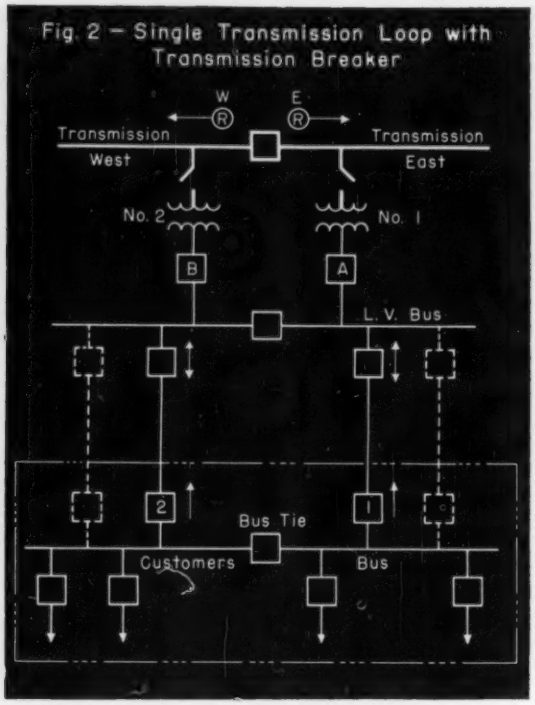
Adapted from a paper presented to the Southeastern Electric Exchange Sales Section.





served for emergencies, the bus tie switch is normally closed along with feeder breaker No. 1; and feeder breaker No. 2 is open. Following loss of voltage, low voltage, or possibly single-phasing indication on circuit No. 1, breaker No. 1 trips and breaker No. 2 closes immediately. When circuit No. 1 has been restored to normal, breaker No. 2 opens after a short delay; and breaker No. 1 closes. During return to normal circuits may be paralleled momentarily to prevent unnecessary voltage dips if circuit characteristics permit.

The tie breaker is not operated during transfer. But it is often provided to sectionalize bus faults and to facilitate switching for planned outages in the customer's system.

With "split feed", breakers No. 1 and No. 2 are normally closed, and the bus-tie switch is open. Trouble on either feed causes that feeder breaker to trip and the bus tie-switch to close, transferring the load to the good circuit. Restoring the faulted circuit causes its feeder breaker to close and the bus breaker to open.

The flip flop is desirable where one circuit has a better expected performance or where the customer wishes to leave out the bus tie switch. Split feed is usually preferrable where the two supply circuits have comparable performances. It allows lower loading of lines and equipment, thereby decreasing losses, improving voltage regulation, and preventing service disturbances to the entire plant.

Both automatic transfer arrangements require special relaying to enable customer's motors and equipment to ride through a disturbance without affecting their operation. Relaying must be able to recognize the loss of synchronizing power, usually within 10 to 20 cycles, so that transfer is made before motors slow sufficiently to cause them to stall and before their contactors drop out.

A conventional undervoltage relay will not detect this condition accurately because motors will regenerate considerable voltage for as much as 2 to 5 seconds. This voltage can go to 170% of normal on circuits where capacitance exceeds the normal excitation of the motors. Inherent saturation is the high-voltage limiting factor in such cases.

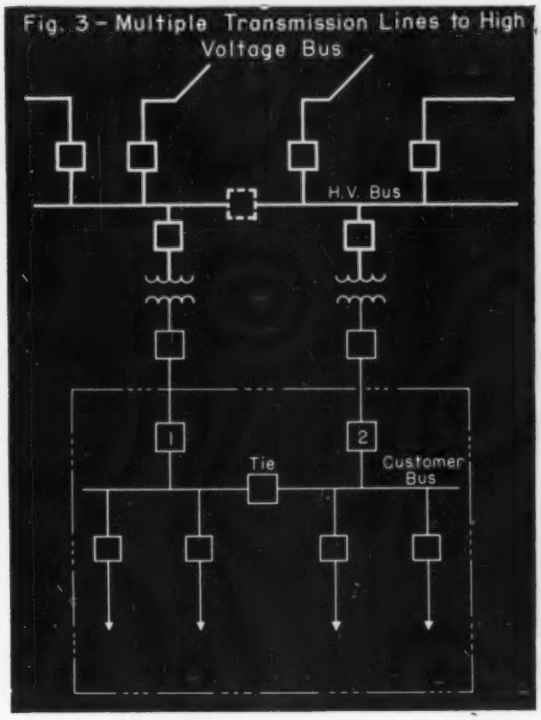
Faults that do not cause an immediate voltage collapse are usually cleared with a high-speed underfrequency relay that recognizes frequency drop to a predetermined value (usually 58.5 cps) within two cycles. This relay is backed up by 3-phase undervoltage relaying to detect a voltage collapse and single phasing.

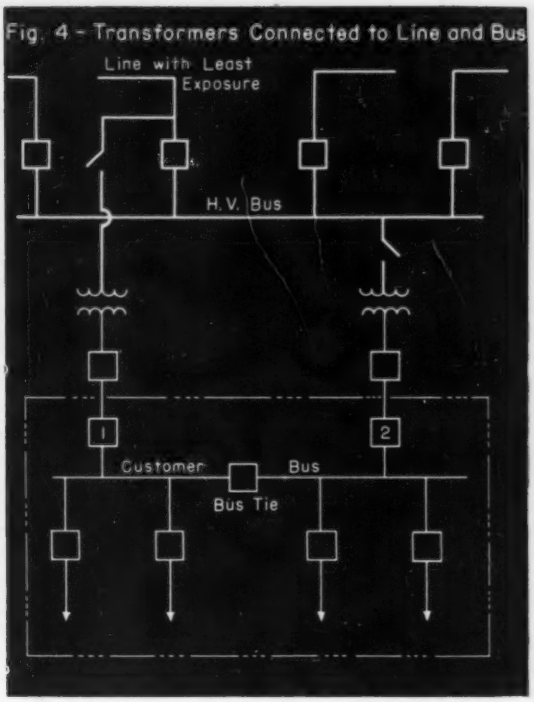
Where this scheme is employed, tests indicate that frequency of the plant system usually drops to 58.5 cps in 10 to 25 cycles after loss of power. An additional 20 cycles is required for the frequency relay to trip one breaker and close the other. But an under-voltage relay might not see the condition until 4 to 5 sec have elapsed, and this would be too long to keep motors on the line. Individual motors have wide variations in voltage and frequency decay rates, depending upon individual inertia constants, shaft torque load, etc. But a satisfactory consistency has been found for the composite of motors.

Field tests coupled with actual experience in several installations have proven automatic transfer to be very satisfactory. But the customer must equip motors and other important equipment with devices to prevent drop-out during momentary voltage dips. Other advantages are:

1. Reducing short circuit duty on customers' switchgear and other equipment to about half the value experienced with normal parallel operation.

2. Enabling the use of independent sources to diversify some of the





more important loads when bus tie breaker is employed.

At sites where only one transmission loop circuit is available, one transmission breaker is installed in the line as shown in Fig 2. Two sets of transmission line relays are provided, one set looking in each direction, and a transformer is connected on each side of the normally closed breaker. This scheme gives two independent circuits and allows the line to operate as part of the transmission grid.

Relaying is arranged to trip transmission tie breaker "T" for a transmission or transformer fault in either direction and to trip the associated transformer low-voltage breaker. Thus a fault on the east transmission line or transformer No. 1 trips breakers "T" and "A", and the load is supplied through transformer No. 2 and the line from the west; and vice versa. Transmission line relaying is usually of the high-speed carrier-supervised type to insure rapid clearing, minimize damage, limit the duration of disturbance, and permit reclosing of circuits at high speed.

This transmission and substation arrangement allows a choice of operating procedures. Two or more circuits from the substation to the customer's bus may be operated in parallel, with directional relays to insure selectivity. Or circuits could be arranged to utilize automatic-transfer features. Parallel operation would eliminate the short-time loss of synchronizing power encountered with the transfer scheme, but short-circuit duties would be more severe on customer's breakers.

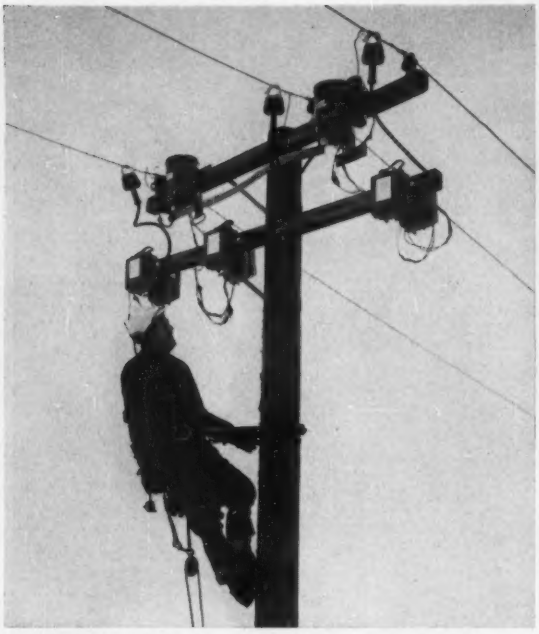
This scheme and the transfer arrangement both have an advantage not provided by some more costly and complicated designs with multiple transmission circuits and breakers. It is that trouble in any elements of one source does not interfere with the ability of the other circuit to supply the load uninterrupted.

Another arrangement for supplying gold-plated service is shown in Fig 3. Here three or more transmission circuits are bussed, and load is supplied from the transmission bus. This requires a high-voltage breaker for each incoming line, each transformer, and the bus tie if service is to be uninterrupted during loss of either transformer or any transmission line.

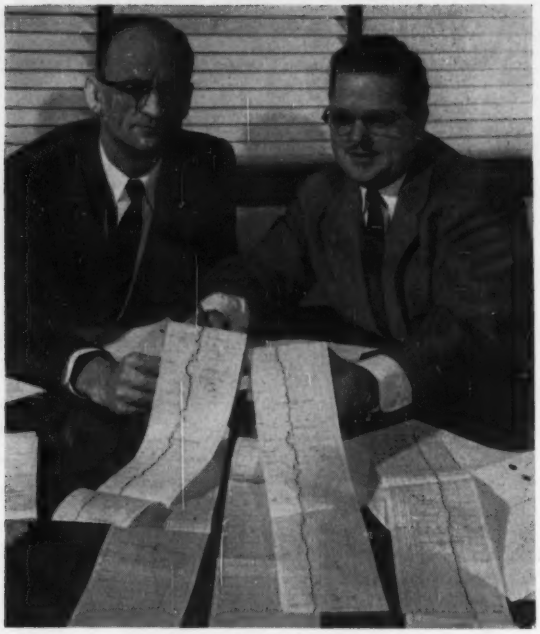
Fig 4 shows a variation of the multiple-circuit station. Here one transformer is connected to an incoming line, preferably the one with the least exposure. The other transformer is connected to the transmission bus. This arrangement eliminates the need for high-side breakers on transformers and the high-voltage bus-section breaker, saving three breakers in some installations.

Regardless of the arrangement selected and its maintenance, unsatisfactory performance can be expected unless the user provides equipment with the required characteristics. Undervoltage devices and automatic equipment with conventional ac-operated holding coils operate almost instantaneously. Voltage disturbances usually last 5 to 15 cycles (time for relaying and clearing breakers on faulted feeders nearby) and can hardly be noticed in lights. Yet they will trip certain motors and devices off the line unless suitable devices are provided to prevent fast tripping.

Application of time-delay undervoltage devices is not restricted to gold-plated service. Louisiana P&L has insisted for years that industrial customers consider use of time-delay devices to prevent needless shutdowns. With these devices and high-speed reclosing (20 to 30 cycles) on all transmission and distribution circuits, customers' equipment will ride through most transient tripouts and voltage dips caused by trouble on nearby circuits or within the plant.



AMMETERS and voltmeters are back-to-back on a crossarm for obtaining simultaneous load, voltage data on three phases at same place. Six instruments are installed on pole



RECORDED DATA from pole-top meters, including time and duration of loads, enables engineers to devise more economical use of Detroit Edison Co's distribution facilities

Pole-Top Graphics Boost Accuracy

Convenient, economical method of measuring assists economical planning and operation of distribution facilities

C. L. MONTAGUE, Principal Engineer—Planning

ALLEN A. PRICE, Operating Engineer—Overhead Lines, Detroit Edison Co, Detroit, Mich.

Graphic measurement of distribution-circuit voltage and current at strategic points has an accuracy within 1½ to 2%, and the information provided about loads and voltages helps engineers get the most out of distribution facilities while giving customers good service. Substation and distribution transformers can be loaded economically and distribution system losses can be kept within economic limits.

Preassembled graphic-meter installations facilitate testing all three voltages and currents simultaneously on a selected single pole. Installations are made so easily and economically that more extensive testing can be scheduled. And recording all data at the desired point saves engineering time and avoids the inaccuracies of adjusting voltage readings to the location of a load. Charts from substation buses and feeders at the substations supply the required data at that point.

Devise Compact Test Installation

Pole-top installations have been developed for obtaining the desired circuit information on the Detroit Edison system. Six recording instruments are installed on a single pole. The cost of securing simultaneous load and voltage data in the past, plus anticipated expansion of the test program, prompted development of the meter assembly.

Selecting meters with adequate insulation properties and other desirable features, such as built-in current transformers and the required accuracy, was the first consideration. The recording voltmeters and ammeters chosen were companion units with similar mountings.

The recording ammeter has a flexible lead with an attached split-core CT insulated for 8,700 v. It is accurate to within about 1½%. Recording ammeters and voltmeters, both inkless instruments, use 1-in.-per-hr strip charts, and the synchronous chart motor actuates the printing stylus.

The six recording instruments are permanently mounted back to back on a 96-in. crossarm with lag bolts. The assembly is permanently wired for the six instruments and protected by 5-amp, 4,800-v fuses. The meter crossarm may be mounted in a buck position.

Recorded tests permit determination of time and duration of peak loads. Knowledge of the load cycle of large power and other loads guides transfer of loads between distribution circuits to defer expenditures for new substations, increased primary capacity, or other corrective measures. Judicious placement of re-

corders for simultaneous voltage and current tests over a distribution circuit makes possible measurement of load and voltage conditions at peak load time for the entire circuit.

Typical test locations are indicated by A, B, C, etc. on the typical rural distribution circuit map. Each location is selected to procure information specifically needed for circuit analyses. Objectives at each point are as listed below:

A—Circuit Feed Point. Simultaneous current and voltage charts at such locations permit:

1. Calculating distribution circuit peak load.

2. Determining load cycle and duration of peak load.

3. Determining feed-point voltage per phase at light and peak loads.

4. Determining load balance on the 3-phase circuit.

5. Checking the operation of substation or line voltage regulator.

6. Detecting a shift of peak load time on large time-controlled loads, such as water heaters, following a circuit interruption.

7. Determining duration and percent loading on substation equipment, such as line regulators, and on feeder buck or boost transformers.

8. Determining the feeder voltage drop at load time by comparing feed-point charts with substation charts.

9. Determining, by summation with similar charts from the other circuits fed by the same substation, loading and load duration on substation equipment, such as transformers, bus regulators, and substation cable.

10. Determining loading on distribution circuit cable where station exits are underground.

B—Main Primaries. Tests at such locations are usually confined to current charts, the voltage being recorded simultaneously at A. Current charts at such locations permit:

1. Calculating main branch primary peak load.

2. Determining load cycle and duration of peak on main primary branches.

3. Determining load balance at peak load time on main primary branches.

4. Comparing phase currents with those recorded simultaneously on the other main branch primaries to guide the transfer of loads to correct circuit or phase loading.

C—Lateral Primaries. Current and voltage tests are usually made simultaneously on single-phase lateral primaries. Such tests reveal:

1. Peak load information on the lateral primaries.

2. Time and duration of peak loads on lateral primaries.

3. Voltage drop information in main branch primary by comparison with charts taken at location A.

4. Knowledge of lateral primary loads to guide transferring phase-wise to improve load balance on the main branch primary.

D—End of Main Branch Primaries. Current and voltage tests recorded simultaneously at such locations disclose:

1. Peak loads on single-phase lines feeding from the end of the 3-phase main branch primary.

2. Time and duration of peak loads on the single-phase lines feeding from the end of the main branch primary.

3. Load balance at the end of the 3-phase main branch primary.

4. Voltage drop in the main branch primary by comparison with charts taken at other main branch locations.

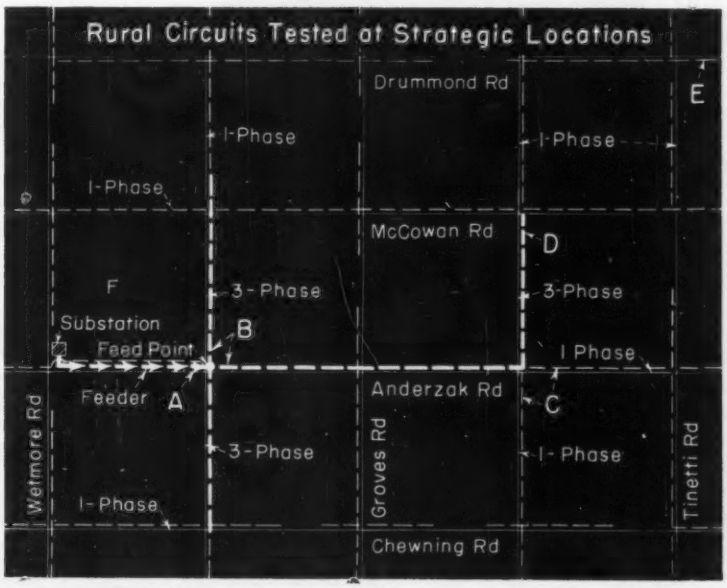
E—Tag Ends of Distribution Circuit. Only recorded voltage tests are taken at these locations. These determine primary voltage conditions. Current tests at the distribution circuit feed point provide the time and duration of circuit peak load.

Current and voltage recordings at typical locations on a distribution circuit provide the information for circuit study. Undesirable conditions, such as excessive voltage drop, overloads, and load unbalance, can be detected and corrected.

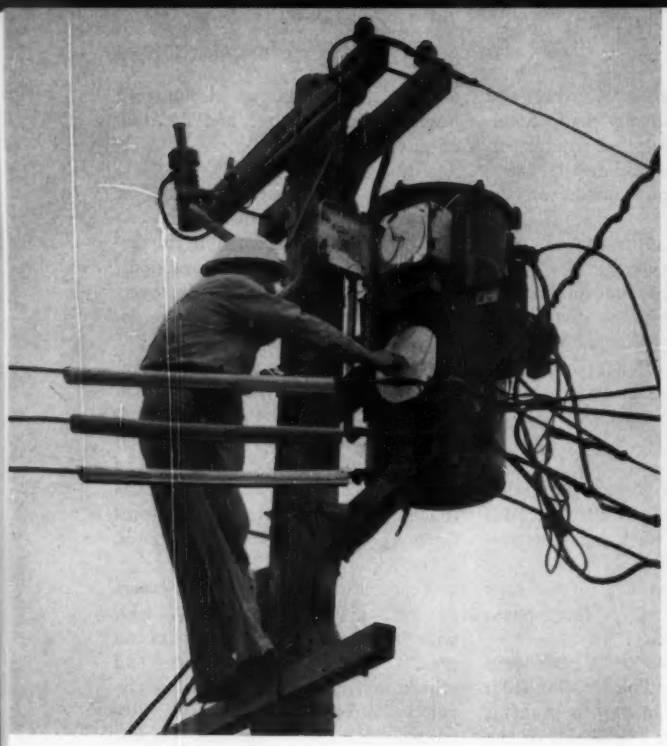
Urban circuits are tested in a manner similar to a rural-type circuit. Urban circuits on the Detroit system usually have the primary ringed, and distances are relatively short. The prime concern on them is thermal loading of equipment, and test locations are chosen to supply the desired current information.

Repeated tests over several years furnish a picture of load growth and, with tests on other circuits in an area, permit the prediction and scheduling of future distribution circuit and substation requirements. Recorded primary voltage and current tests point out the successive steps to be taken in planned development of the distribution system.

Data must be accurate as primary voltage regulation cannot be permitted to exceed 5 v on a 120-v base. A 5% error could lead to unnecessary expenditures or poor service conditions.



TEST POINTS, selected as shown by A, B, C, etc, on this typical rural distribution circuit layout, assures that charts obtained give desired load and voltage data



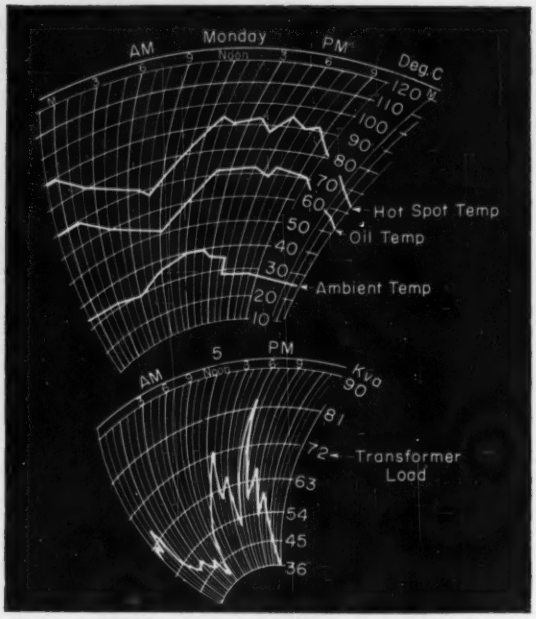


FIG 1—TEMPERATURES AND LOADS were recorded at transformers like that at left in areas like that shown on page 132

Surveys Transformer Loading

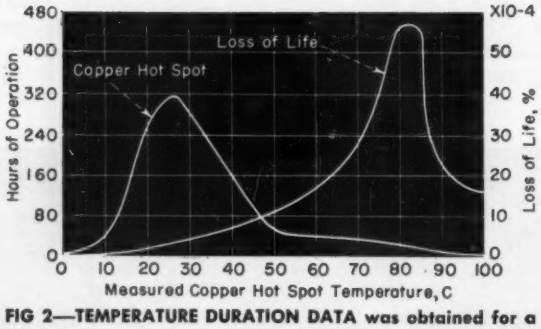


FIG 2—TEMPERATURE DURATION DATA was obtained for a whole year. Fig 3 was used in calculating the loss-of-life

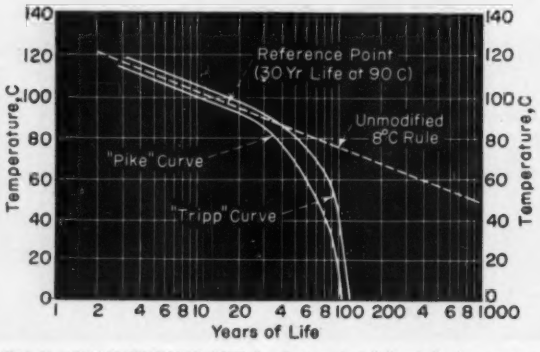


FIG 3—TRANSFORMER LIFE is determined largely by operating temperature. Studies presuppose earlier studies

Commonwealth Edison Co finds maximum winding or oil temperature is more accurate guide to permissible loading today

C. F. MITCHELL, Service and Regulation Engineer, Commonwealth Edison Co, Chicago, Ill.

Maximum winding or oil temperature is today a more accurate gauge of permissible transformer loading than the load tests used before the shift of peak loads from winter to summer. The latter shift has altered the economics of transformer loading which has been further complicated by the changing rate of load growth and transformer replacement costs.

The shift of the peak load season to summer with its high ambient temperatures has changed the old relationship between kva and the thermal loads. When room air conditioner saturation reaches about 20%, the peak load and maximum ambient temperature coincide. Accordingly, a maximum oil or winding temperature indicator becomes the more acceptable means of measuring load. This indicator functions most satisfactorily when it is permanently installed.

The Chicago area experiences maximum or near-maximum temperature only once or twice each summer and then only for an hour or two. Unless the temperature indicator has a supplemental counting or timing device, it is problematical whether it will indicate a serious loss

of transformer life, its operation then depending on the trip setting. Consequently, considerable information on actual transformer temperatures and their relation to load characteristics is essential. Only such knowledge can assure that the utmost advantage is being obtained from equipment thermal capabilities.

To gather this information, Commonwealth Edison Co entered into an agreement with three transformer manufacturers. Twelve 50 and 75-kva transformers were to be equipped with ducts in the windings and tank fittings for installing graphic thermometer bulbs and ammeters. These units were placed at selected points such as the block shown where the room air conditioner saturation for 26 customers was 133%. This was in 1955.

Carried 168% of Rating:

These installations have been in service 18 months. On Aug. 29, 1955, a 50-kva unit carried 168% of its kva rating in an ambient temperature of 40C without exceeding a winding temperature of 100C. In the charts for that date (Fig 1), the curve identified as the hot spot temperature represents the temperature of the bulb in the winding displaced upward 10C.

This transformer reached its maximum copper temperature with a maximum load of only 146% of rating on another day when the load was maintained longer and the air temperature was higher. Fig 2 shows temperature durations through the year Aug. 23, 1954 to Aug. 22, 1955, and superimposed on it is a curve representing the loss of transformer life at each temperature value. The area under the curve represents a theoretical loss of life of 1.17 years, using the established temperature-life relationship given in Fig 3.

Fig 3 thus illustrates the insignificance of much of the time during which the transformer operated at lower temperatures. It also indicates that most commercial temperature indicators would have operated at only slightly higher temperatures although actual loss of transformer life would have been far below generally assumed depreciation rates.

Investigation Extended

Results of these tests have prompted Commonwealth Edison to extend its investigation to much greater loads. The company now knows that a single tripping of an indicator set for 80C top oil temperature or 105C copper temperature doesn't signify an urgent need for replacement. This finding needs interpretation also in the light of the rate of load growth. Field testing in progress is at a load level far below what might shorten transformer life materially.

Laboratory tests at severe simulated load cycles probably could establish loading for an equivalent transformer life of three or four years. The importance of exaggerated load-cycle testing lies in the fact that a decline in mechanical and dielectric strength alone appears to be not enough to bring about transformer failure.

It seems probable now that what causes final breakdown is a combination of differential expansion and contraction with both electrical and mechanical surge stress caused by lightning or heavy loads.

There are at least three approaches to evaluating the effect of loading practices on transformers:

1. The application of mortality characteristic curves.
2. The study of burnout statistics.

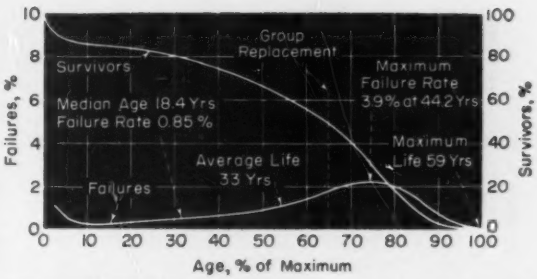


FIG 4—MORTALITY CURVES (above) predict transformer's age at time of burnout. Maximum rate is expected in 26 years

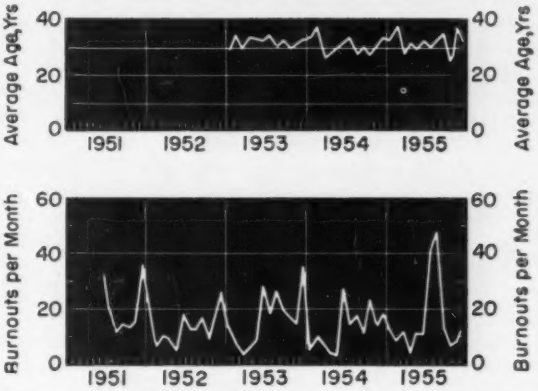


FIG 5—TRANSFORMER FAILURES per month in Chicago are shown by bottom curve, their average age by top curve

3. An analysis of the previous loading history of typical units which have failed.

In evaluating transformer failure rates and predicting losses, Commonwealth Edison developed transformer mortality statistics which are reflected in the lower part of Fig 4. Plotting mortality against life, the curve is applicable to any selected design life. As depreciation reserves are usually set aside at a 3% rate, the significant points for a 33-year life are given as annual values.

The maximum rate of failures of transformers now in use in Chicago can be expected 26 years hence. But the percentage of these transformers on the system at that time will be quite small as a result of their dilution by plant additions in the interim. Needed replacements, expressed in Fig 4's failure percentage, would amount to about 1,800 transformers per year or nine for every Chicago working day. Probably half of these failures would occur during the few days of temperatures over 95F.

In such circumstances, one way of avoiding impaired service would to be prepare for the maximum-failure period by group replacement. The portion of useful life lost through a group replacement policy can be gauged from the survivorship curve, and the portion of Fig 4 under it and to the right of the line drawn to indicate when 50% of the transformers would remain in service.

When the transformer record is designed to include the determination of age groups, life expectancy and probable failure rate in future years can be determined with considerable accuracy.

Operating people more readily accept a group replacement policy supported by an interpretation of actual

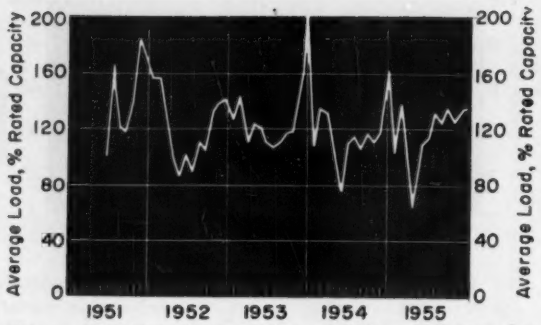


FIG 6—AVERAGE LOAD at time of failure indicates that past loading is as important as load preceding burnout

operating records. Of such records, burnout rate is commonly the most significant. Fig 5 shows the number of failures per month in Chicago for the 20,000 units serving principally residential load.

Chicago's maximum failure rates before 1955 occurred during the Christmas rush season. But in 1955 air conditioning loads pushed summer failure rates above those for winter. An average transformer life of more than 30 years, however, can still be expected.

The top curve of Fig 5 shows the average age of a transformer at the time of failure. The average shown is about 30 years. But careful scrutiny reveals a decline of about one year per year, apparently reflecting the steps taken toward heavier loading over the past 25 years.

Results of the performance study prompted an analysis of a 600-unit sample of transformers on the system to obtain a better understanding of the reasons for the trend. Average loading was 107%. This loading is 10% below the average of 117% which should be attainable with maximum winter capability of 140% of rating, excluding holiday loads.

The rapid rate of load growth has made the changeout to the second larger transformer size most economical. Such changeout, it is believed, accounts for the spread between the theoretical loading and that experienced.

Average loading of transformers at the time of failure (Fig 6), indicates that the past loading is fully as important as the load immediately preceding burnout. On this basis it was concluded that, as deterioration is cumulative, it is just as important to relieve overload on a new as on an old transformer, perhaps more so as very little useful life remains to be saved in the older one.

With suitable protection modern transformers are quite resistant to lightning damage. But deterioration of insulation by excessive heat renders them more susceptible to damage by voltage surges.

When life records and loading histories are on hand, the effects of previous loads can be translated into a theoretical expired life by means of the curve in Fig 3. As the actual life is known, the curve may be corrected for a sufficiently representative sample to conform to experience. The method of correction has been described by Perry Shelley (EW, Oct. 28, 1944, p 86).

Actual Loading Important

To make the most of available information on the effect of transformer loading, actual loads must be determined. For this purpose a thermal maximum demand indicating ammeter has been widely used although its limitations are recognized. Measurements thus obtained are used as a basis for estimating loads and load growth on transformers not measured.

Although such methods are applicable especially to conventional transformers, winding temperature is the final criterion of permissible loading. Daily load factors and annual duration of peak loads are necessary for converting demands into thermal duty.

As permissible loading is based primarily on maximum temperature and its duration, a number of devices for indicating transformer temperature have appeared. These fall into three general classes:

1. Oil temperature indicators.
2. Winding temperature indicators.
3. Simulated winding temperature indicators which tend to match the thermal time constant of the transformer. These devices are especially suited to measuring summer peaks.

The problem of handling system load with the least annual cost for distribution transformers admits of no precise answer. The answer must differ greatly with the character and age of the overhead plant, growth characteristics of the neighborhood, and the climate.

A CHICAGO BLOCK, with 26 customers and 133% saturation of air conditioning, was allotted special transformers

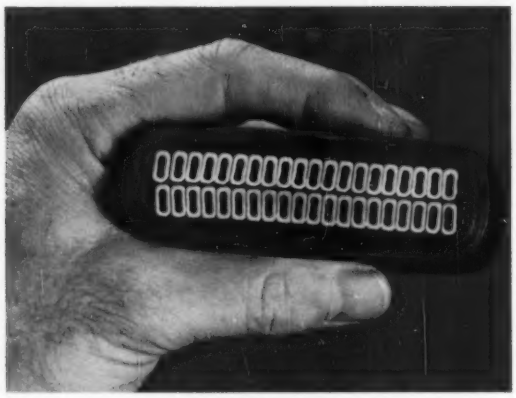
World's first large generator with liquid-cooled armature windings goes to Eastlake

New General Electric cooling system

...without appreciable

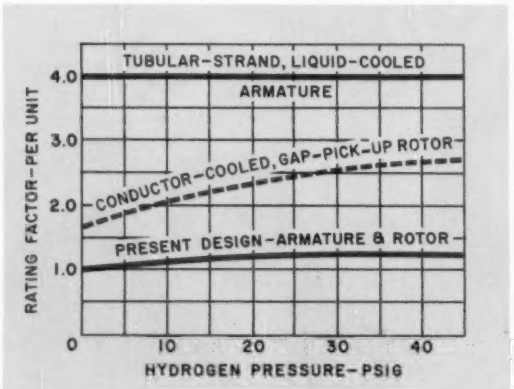
This evolutionary new 260,000-kva generator incorporates one of the most significant advances in generator cooling since General Electric pioneered hydrogen cooling in 1937. Now in operation at the Cleveland Electric Illuminating Company's Eastlake Plant, it is the world's first large generator with liquid-cooled armature windings. The liquid circulates right through the conductors.

THIS DESIGN IS THE MOST EFFECTIVE method of cooling yet developed. Combined with the new conductor-cooled, gap pick-up type rotor, a typical unit's rating may be doubled without appreciable increase in physical size.

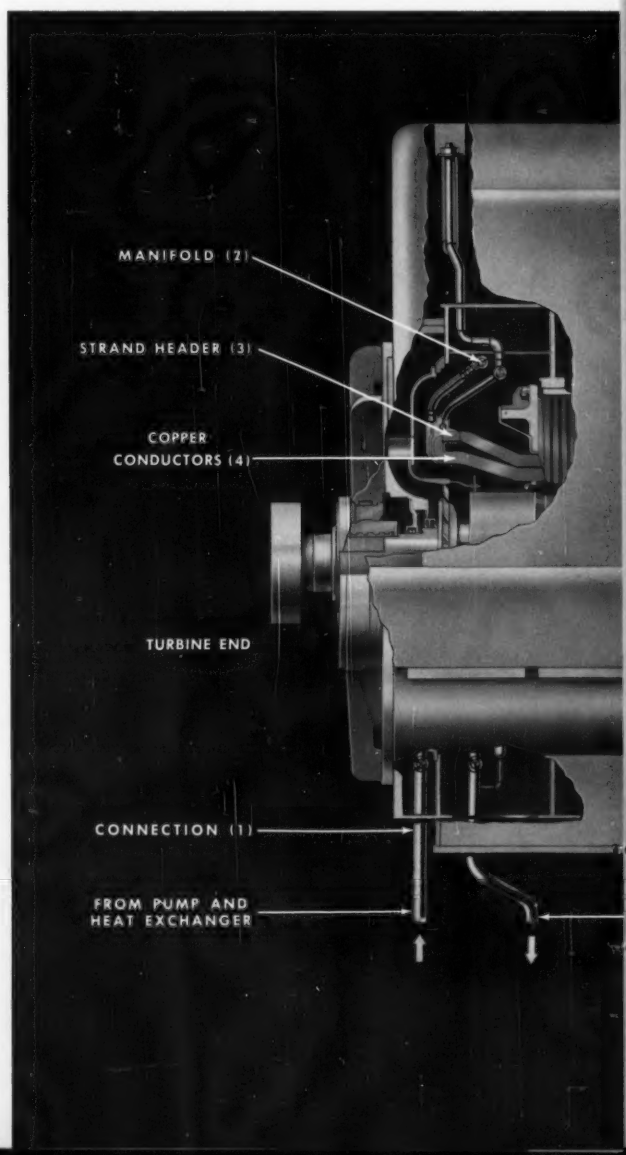


CROSS-SECTION OF ARMATURE BAR shows hollow tubular conductors which carry liquid coolant as well as current. Maximum heat removal is possible because of direct contact between cooling liquid and conductors.

COOLING LIQUID enters tubular conductors through strand header at end of armature bars. Cut-open section above shows how conductors are brazed to header.



HIGHER CAPACITIES are possible with new G-E conductor cooling development. Bringing liquid coolant in direct contact with the armature conductors can remove as much as sixteen times the heat that could be removed from them through the normal ground insulation with the same copper temperature.



can double generator rating

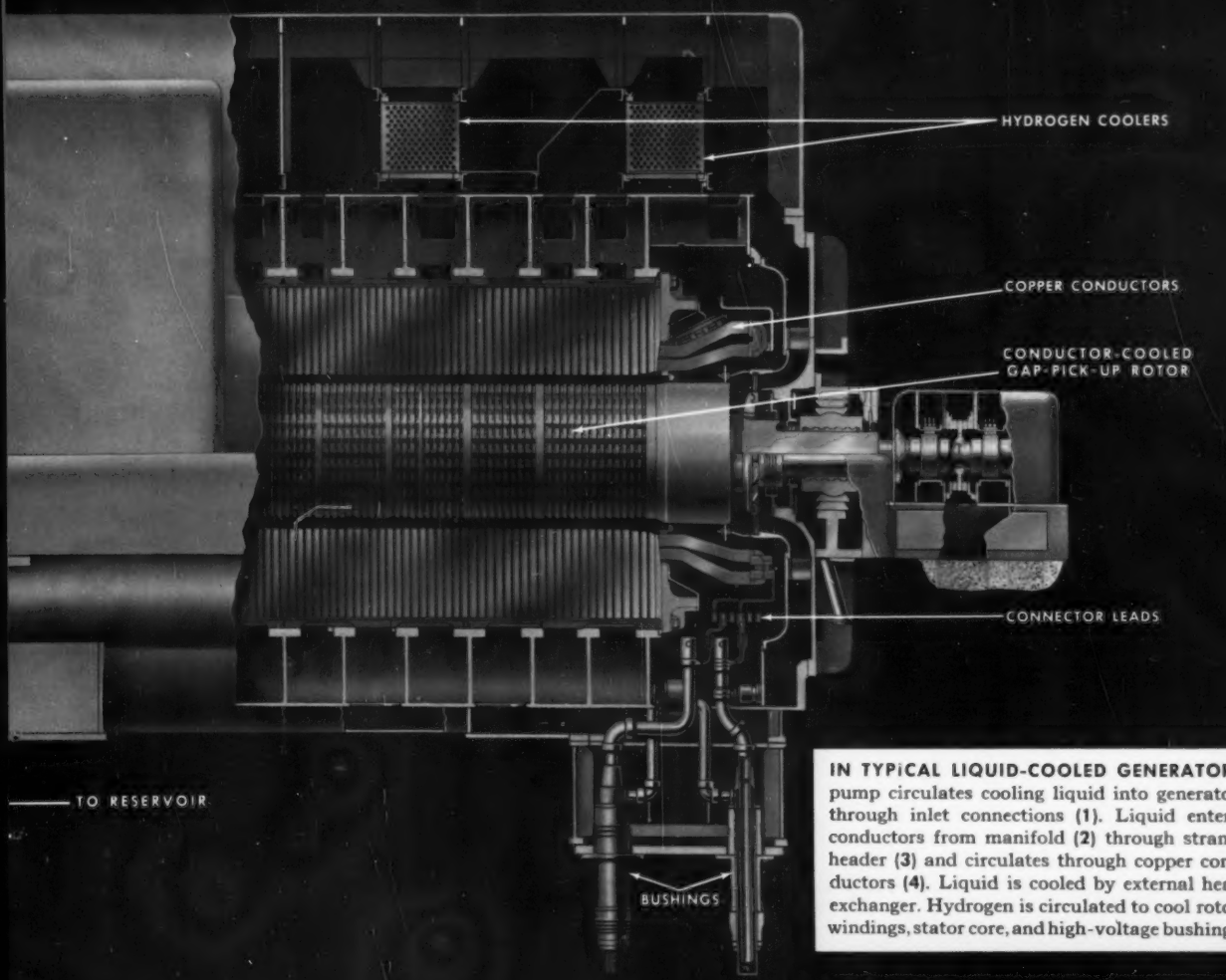
increase in physical size

Even with the increased current output made possible by liquid cooling, efficiency of this General Electric unit remains high. Design features such as: extra transposition of end windings; copper shields on the stator core clamping flanges; and machine dimensions specially designed to reduce windage losses, all contribute to this high efficiency.

The coolant circulates in a double wall guarded circuit within the armature frame. A special brazed header provides permanent joining of tubular armature conductor strands. Both the liquid and the parts enclosing the coolant are carefully selected for noncorrosive characteristics.

This 260,000-kva, 30 PSIG Eastlake generator is the largest so rated 3600-rpm generator in the world. The new design developed for Eastlake is a significant step toward doubling generator ratings without appreciable increase in frame size and points the way to much larger machines—as high as 500,000-kva. For more information write for GER-1231, "Liquid Cooling of Turbine-Generator Armature Windings," Large Steam Turbine-Generator Department, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC



IN TYPICAL LIQUID-COOLED GENERATOR: pump circulates cooling liquid into generator through inlet connections (1). Liquid enters conductors from manifold (2) through strand header (3) and circulates through copper conductors (4). Liquid is cooled by external heat exchanger. Hydrogen is circulated to cool rotor windings, stator core, and high-voltage bushings.

New generator produces 66% more power in same turbine room space

Eastlake's new General Electric conductor-cooled 260,000-kva generator (above) represents another milestone in turbine-generator progress. The new generator has increased station capacity 56% yet occupies the same turbine room space as each of the three other conventionally cooled, 156,250-kva General Electric units in this modern plant.

Obtaining more kilowatts in the same turbine room space is one of the many challenges created by the increasing expansion of electric utility loads. The Eastlake installation demonstrates how this challenge can be solved by advanced designs.

It is a typical example of how the electric utility industry and equipment manufacturers are cooperating to meet tomorrow's demand for larger blocks of power with turbine-generators of even higher ratings.

This latest expansion of the Eastlake plant is a further step in Cleveland Electric Illuminating Company's program of helping its customers to Live Better ... Electrically. 254-45

LIVE BETTER ELECTRICALLY

Progress Is Our Most Important Product

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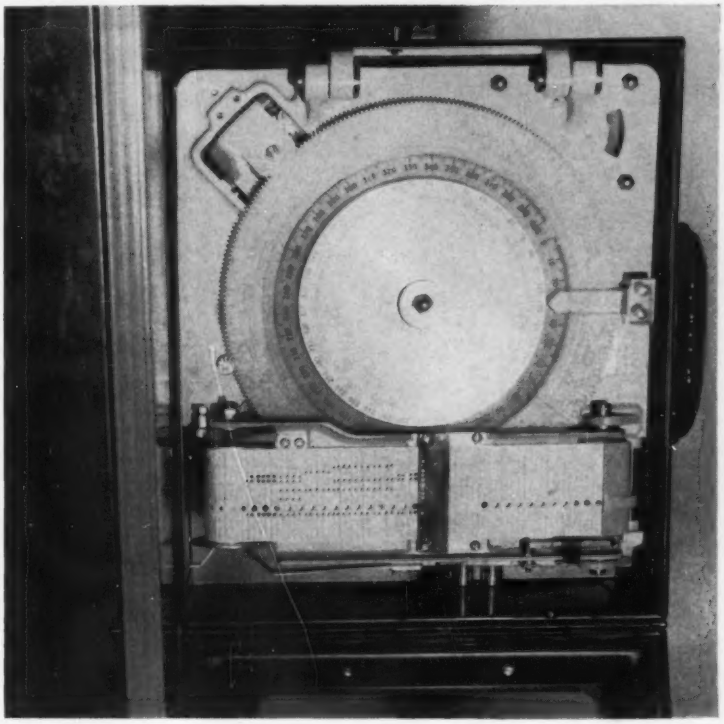
TODAY'S DESIGN TREND

Demand Meter Produces Punched-Tape Record Fast



A new type demand recorder which automatically produces a punched tape record of watthour demand, has been developed for reducing the man-hours required for load surveys and customer demand billing.

The punched paper tape output of this digital demand recorder can be read visually or processed quickly by an automatic tape translator operating an IBM card punch. Speed of the translator, operating an IBM 526 summary card punch, is enough to place all watthour demands from 50 monthly, 30-min demand interval customer tapes onto punched cards in a single man-day.

Demand Goes on Tape

The recorder, developed by Fischer & Porter Co and designed in collaboration with the electrical utility industry, has a pulse-counting mechanism, a paper-punching and transport mechanism, and an interval timer. Contact closures from the contact-making mechanism in the watthour meter are added in the pulse counter. At the end of the demand interval, the punching mechanism is actuated, and the watthour demand is punched on paper tape.

The paper tape is then advanced and the counter zeroed. This cycle is repeated at the end of each demand interval. The output is a punched paper tape record of watthour demands.

The pulse-counting mechanism consists of a spring-loaded nylon disc which is rotated step-wise from the zero stop to a maximum of 400 positions in one rotation. Each of the 400 positions has a particular arrangement of hills and valleys on the face of the disc. The arrangement at any particular position represents in code the number of counts it takes to drive the disc from the zero stop to that position. To rotate the disc in steps, the disc is coupled at its periphery to a small gear, ratchet, fan, and solenoid assembly. Each pulse entering the counter mechanism operates the solenoid to step the disc one position. This process continues for the length of demand interval.

Bouncing Eliminated

The punching mechanism is a punch and die on a punching arm. Paper tape passes over a sprocket and ratchet at the hinge line of the punch arm and passes through the punch and die to the paper take-up mechanism. At the end of the demand interval, the interval timer actuates the punch arm solenoid, and the punch and die is pulled down to the counter disc.

Individual punches can then detect either hills or valleys on the counter disc. Punches contacting hills are driven upward to punch the paper directly. Thus the number of contacts in that demand interval and, therefore, the watthour demand, is punched in the paper in code. As soon as the paper is punched, the punch arm is released to its home position. During the punch arm's backward stroke, the paper is moved forward by the sprocket and ratchet and is taken up by the ratchet and slip clutch driving the take-up roll.

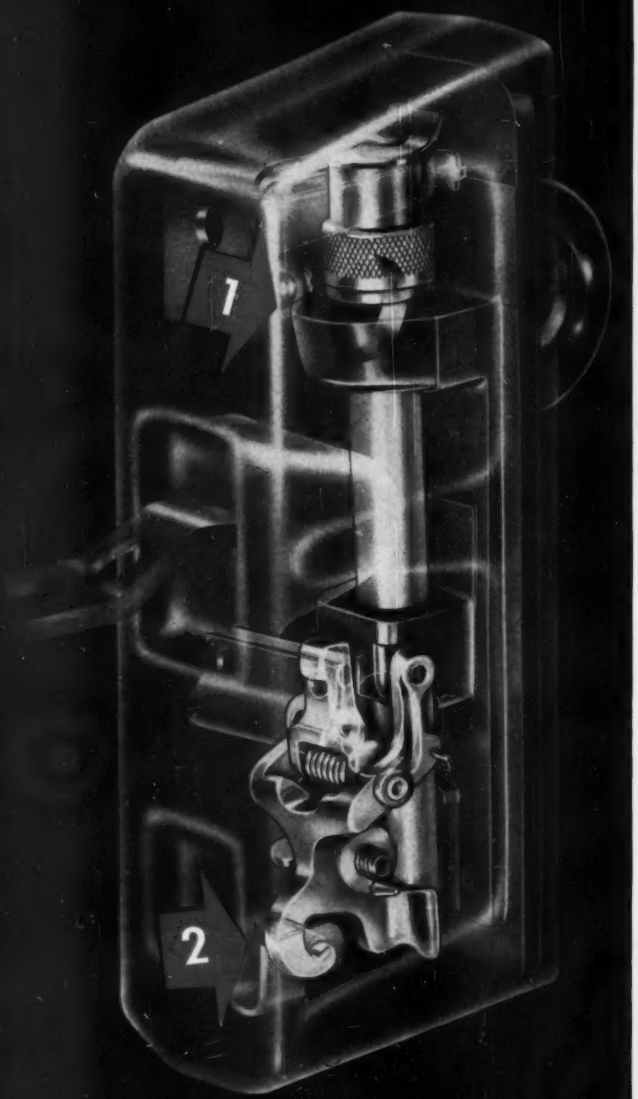
When the punch arm has returned to the home position, the counter disc is released and rotates home to the zero stop. The fan attached to the gear at the periphery of the counter disc acts as a dynamic brake on the return of the disc. The brake, plus the use of nylon, assures that the disc does not bounce when it hits the zero stop.

Procedure Takes 2 Sec

The entire procedure of punching and zeroing takes 2 sec and is repeated at the end of each subsequent demand interval.

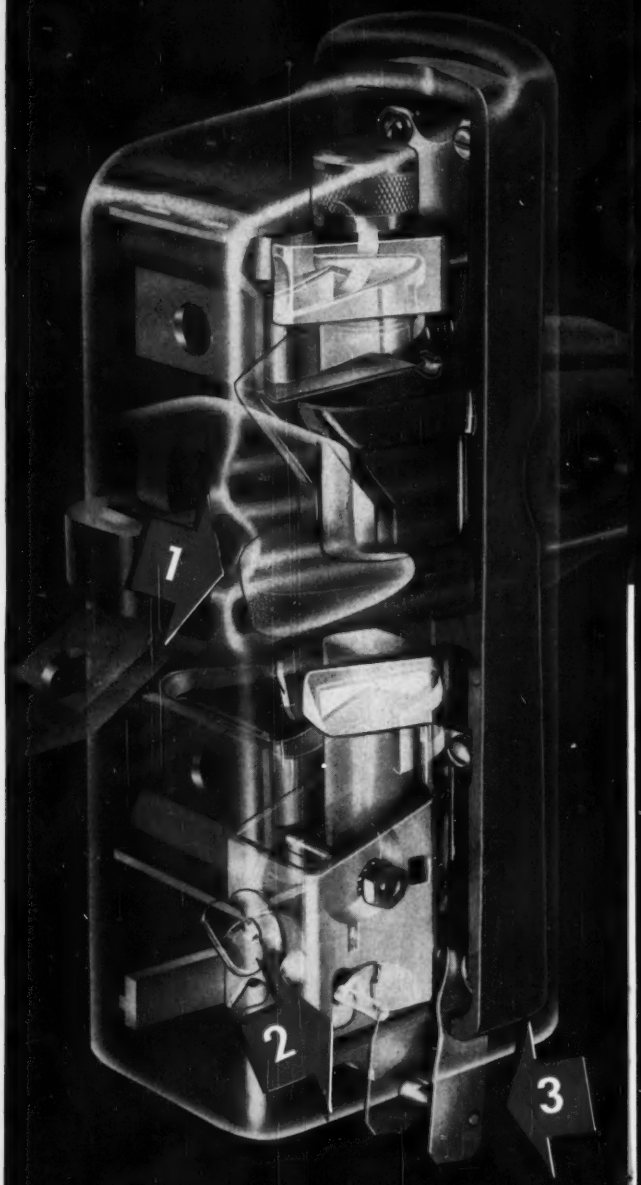
The input circuit operates from a

old



1. Old-type barrier overlaps housing barrier retarding flow of expulsion gases—
2. Single-hinge hook made removal and replacement of door difficult.

new



1. Snug-fitting neoprene rubber barrier prevents expulsion gases from bridging cutout contacts.
2. Double-hinging of cutout door provides for accurate door closing.
3. Semaphore gives reliable indication of blown fuse—easily seen from the ground.

ALL-NEW ENCLOSED FUSE CUTOUTS

now...

Snug-fitting neoprene barrier prevents internal flashovers

Double-hinging assures accurate door closing

Flip-out semaphore indicates blown fuse

SNUG-FITTING NEOPRENE BARRIER stops potentially dangerous expulsion gas flashovers from occurring between contacts in General Electric's all-new enclosed fuse cutout. This neoprene rubber barrier fits snugly around the fuseholder and, in conjunction with contoured porcelain of the housing, provides an effective seal.

DOUBLE-HINGING OF CUTOUT DOOR to porcelain housing provides for accurate door closing. Provides more stable support for removal and replacement of cutout door in service. Non-ferrous housing hinge pins give longer life even under severe service condition.

FLIP-OUT SEMAPHORE gives clear indication of blown fuse. This spring-actuated device at the bottom of the fuseholder aids instantaneous flip-out of the fuse link cable after the fuse blows. This is particularly important during low-current interruptions. As a semaphore, it gives reliable indication of a blown fuse because it can be easily seen from the ground—a real advantage on non-dropout units.

ALL FROM ONE SOURCE—General Electric's new Enclosed Fuse cutout line gives you a choice for every need—indicating-dropout, indicating-non-dropout, disconnect—in one basic design. You can select from two current ratings, 50 and 100 amperes, and two voltage ratings, 5.2 and 7.8 kv, to match every system demand.

OTHER FEATURES your lineman will like: safety-grip door handle (puts an end to switchstick juggling)—unique plastic-to-metal latching (prevents door "seizing")—extra easy fusing and line connecting for fastest possible installation and servicing.

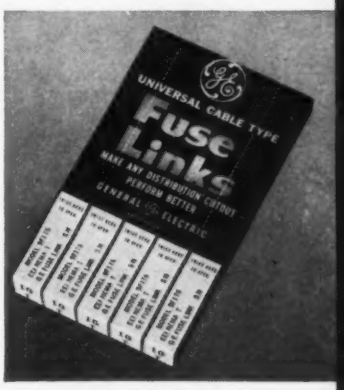
For a complete description of the new cutout line, write for Bulletin GEA-6208, General Electric Company, Section 433-16, Schenectady 5, New York.

Accurate—Highly Dependable General Electric Fuse Links

Assure maximum effectiveness of your General Electric Fuse Cutouts with General Electric Fuse Links that feature:

Low-melting point alloy of lead and silver in fusible element . . . Specially stranded cable for maximum flexibility . . . Lowest resistivity . . . Auxiliary Fuse tubes that will not warp or shrink . . . Proper balance of strain wire and fusible wire . . . Button cap seal and solid washer to confine gases . . . Assure positive operation . . . simple replacement.

Order them from your General Electric Distributor today.



Progress Is Our Most Important Product

GENERAL ELECTRIC

two-contact, three-wire contact-making mechanism so as to avoid false counts introduced into the counter. An extremely low current RC-shunted relay, associated with each contact in the contact-making mechanism of the watthour meter, eliminates contact pitting. The two relays operate in a latching circuit, so that when they have operated in sequence, the counter-disc solenoid and a six-digit counter are operated.

Disc Clearly Marked

To show position of the counter disc at any time—and consequently the present interval demand—each position on the disc is clearly marked from 0 to 400. The counter disc drives a smaller disc also marked from 0 to 400. The latter remains at the highest position to which it has been driven, consequently showing the maximum watthour demand recorded since the last manual reset.

The interval timer is a silicone-lubricated, long-life synchronous motor geared to two notched cams. Interval timing is accomplished by a snap-action switch operated from a roller riding on the cams. One cam rotates one revolution a minute, and the other one revolution in the time interval. When the notches on the two cams are adjacent, the roller drops in the notches and actuates the snap-action switch. The switch starts the punching, tape advance, and zeroing cycle.

The interval timer has a clearly marked interval disc which makes one complete rotation for each interval. It can be set manually in relation to actual time through a one-way slip clutch in the synchronous motor.

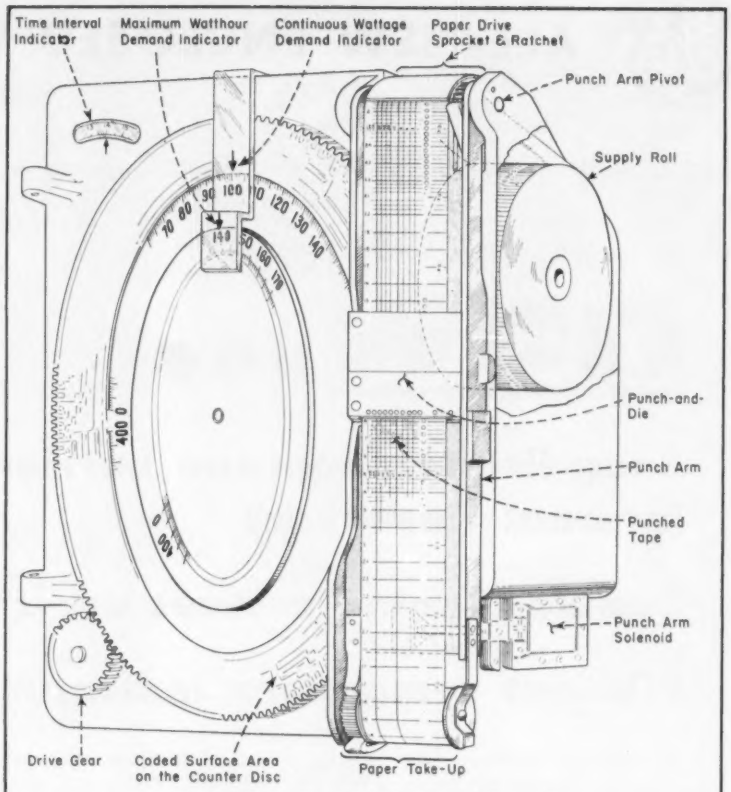


Fig. 1. Schematic, Digital Demand Recorder

The binary-decimal code used in the recorder can be mechanized simply and read easily. To code 377, as shown in Fig 2, holes are punched in the units column at positions 1, 2, and 4; in the tens column at positions, 10, 20, and 40; and, in the hundreds column at position 100 and 200. The sum of all numbers adjacent to each punched hole is 377.

The paper tape is code and time printed, ⅛ in. on tape being equal to one demand interval. For a 15-min demand interval, about 31 ft of recording tape is used in a month. The 200-ft supply roll is enough for six months for a 15-min demand interval and for a year for a 30-min demand interval. The last month's supply is indicated by a red stripe. Tape for 6 to 24 hr operation is always visible.

Visual reading of the punched tape can be more rapid than visual reading of graphic recordings. This holds true when demand for all demand intervals is read (as in load research), or when only maximum demands are read (as in customer demand billing). To select the maximum demands, the reader simply scans the hundreds column and picks out the highest punches, then he scans the tens and units columns of the selected high hundreds punches. The result is quick and easy visual selection of maximum demands in a month.

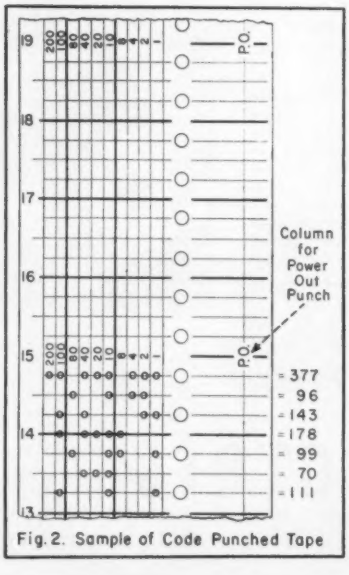


Fig. 2. Sample of Code Punched Tape

Optional features are:

1. An electrically operated six-digit mechanical counter for checking the contact-making mechanism of the watthour meter.

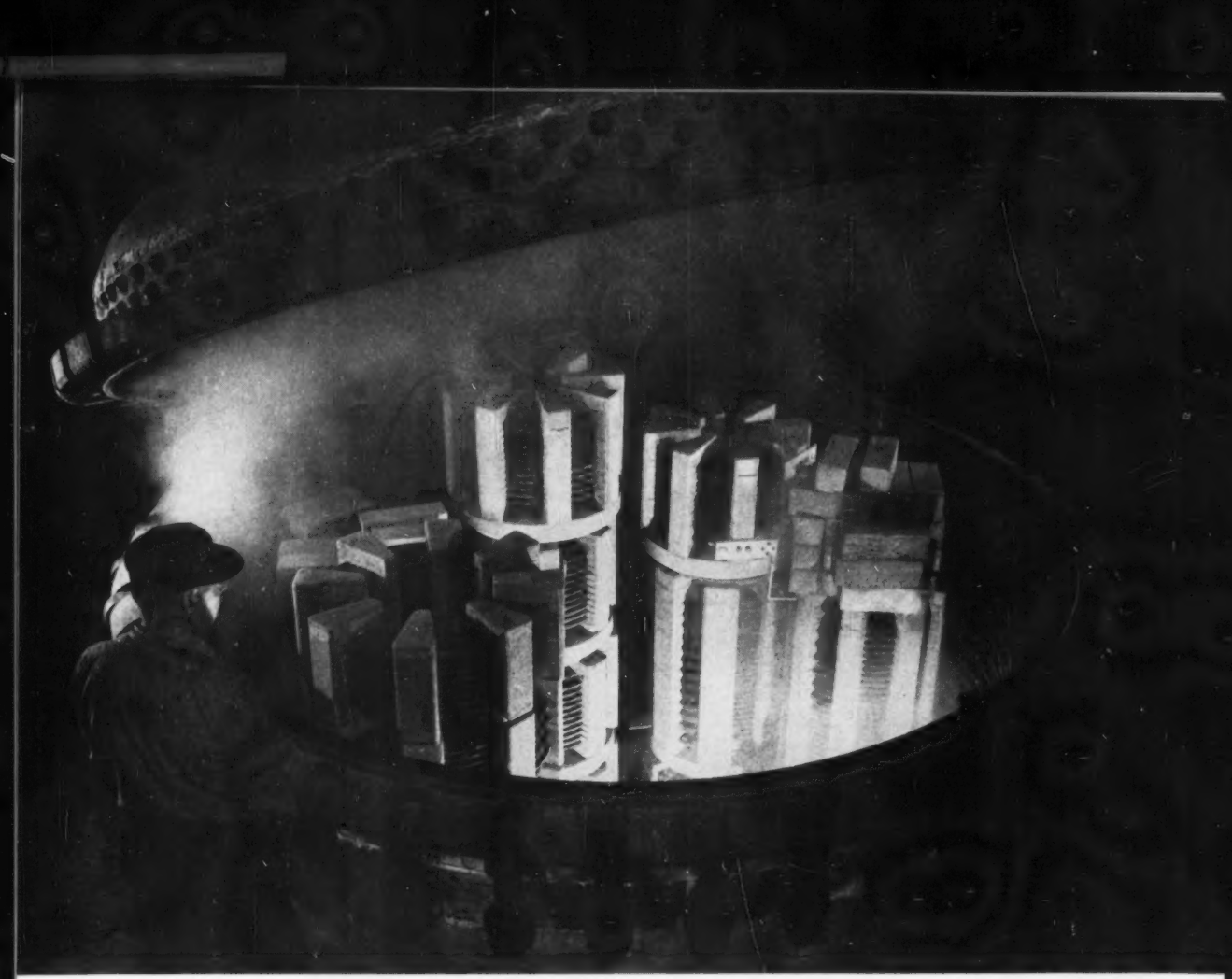
2. Two extra punches for punching information other than watthour demand, such as, power failure.

3. Maximum demand recorded since the last manual reset can be shown by use of a marked disc driven by the counter disc.

4. Alarm contacts.

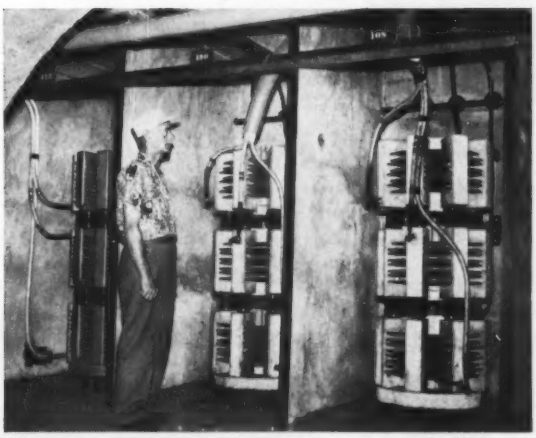
5. Time intervals other than the standard ones—15, 30, and 60 min—will be made available when requested.

(*More How To on page* 149)



PROVEN WET-STEAM CURING PROCESS MAKES

General Electric cast-in-concrete reactors stronger, more reliable



37 YEARS OF SERVICE have been achieved by these G-E cast-in-concrete reactors at Fall River Electric Light Co., Fall River, Mass. Twelve reactors, installed in 1919, are as strong as ever and have required practically no maintenance.

RELIABILITY that begins at the moment of installation and lasts through a longer life is assured to you by General Electric's time-proven methods of manufacturing cast-in-concrete reactors. Using its exclusive wet-steam curing process, G.E. achieves in two days a degree of concrete curing which would be obtained only after several weeks of normal, in-service curing. This unique 180° C steam bath gives you stronger, more reliable reactors than any other curing method in use today.

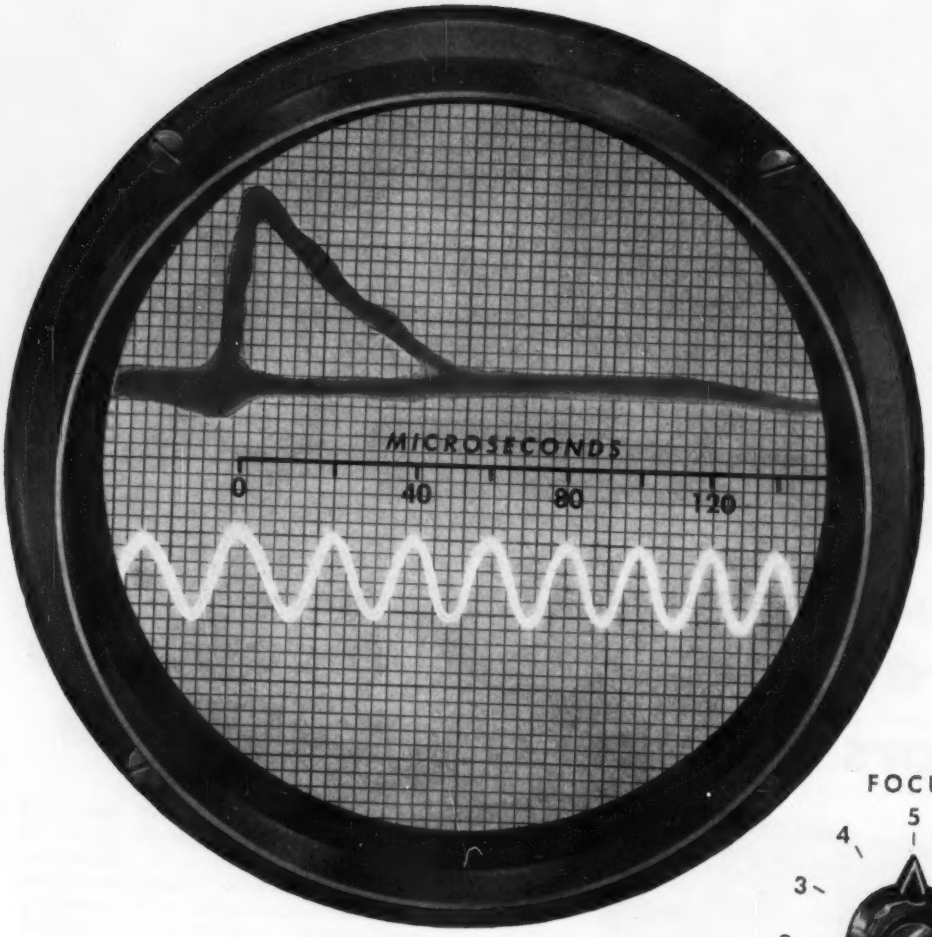
PROOF OF THE STRENGTH of properly cured concrete reactors is demonstrated daily by thousands of G-E reactors in service across the country (see photo left). For other benefits of G-E reactors, contact your local G-E Apparatus Sales Office or write General Electric Company, Schenectady 5, New York. 422-32

Progress Is Our Most Important Product

GENERAL ELECTRIC

DISTRIBUTION TRANSFORMERS

THIS IMPULSE TEST



FILAMENT

SCREEN LIGHT

EXCITATION

COULD SAVE YOU...$45

Estimate your possible savings in terms of all transformers on your lines

When General Electric started production-line impulse testing its distribution transformers in 1946 more than 15% of the units were rejected. These units had previously passed **all other tests.** Had these transformers been shipped, they might have given years of satisfactory service under normal conditions, or they might have failed under sudden stress.

By weeding out failures in advance it is conservatively estimated that the average life of distribution transformers is increased 15%. Based on the cost of a 25-kva, 2400-volt unit this means a $45 saving on each transformer.

Impulse testing makes the difference. Every unit 100 kva and below has both high- and low-voltage windings tested on the G-E production line without lightning protection of any kind. Any hidden weakness is detected automatically and the faulty transformer is rejected. This means that every G-E distribution transformer you add to your system has already been proven under greater stresses than encountered in normal service.

Look at the other money-saving features that prove "All transformers are not alike": **One-piece clamping bands,** for instance, save maintenance time. Reusable **Nitrile rubber gaskets** help save units from contamination. **AL/CU terminals** are designed to prevent both copper and aluminum conductors from loosening. **Strenicor terminal clamps** save terminals from breaking. **Super Melaglyp paint** saves up to two repaintings. **Nationwide warehouses** save utilities heavy inventory expense. **Service shops** can cut your repair and rebuilding costs.

For the complete story contact your nearest G-E Apparatus Sales Office or G-E Agent—or write to General Electric Company, Schenectady 5, New York. 431-36

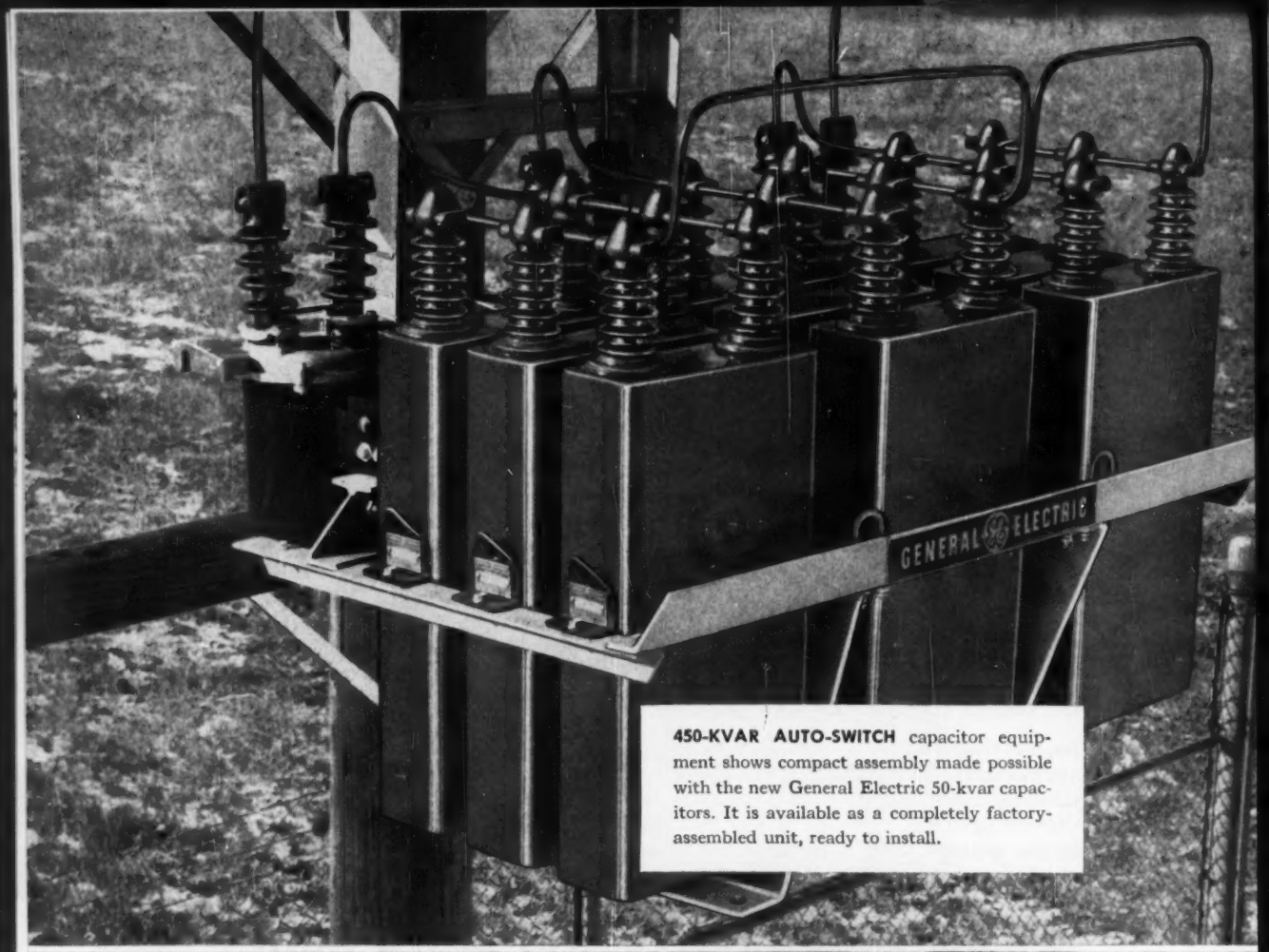
dollar-saving features prove ATANA*

*ALL TRANSFORMERS ARE NOT ALIKE
(make this simple comparison and see)

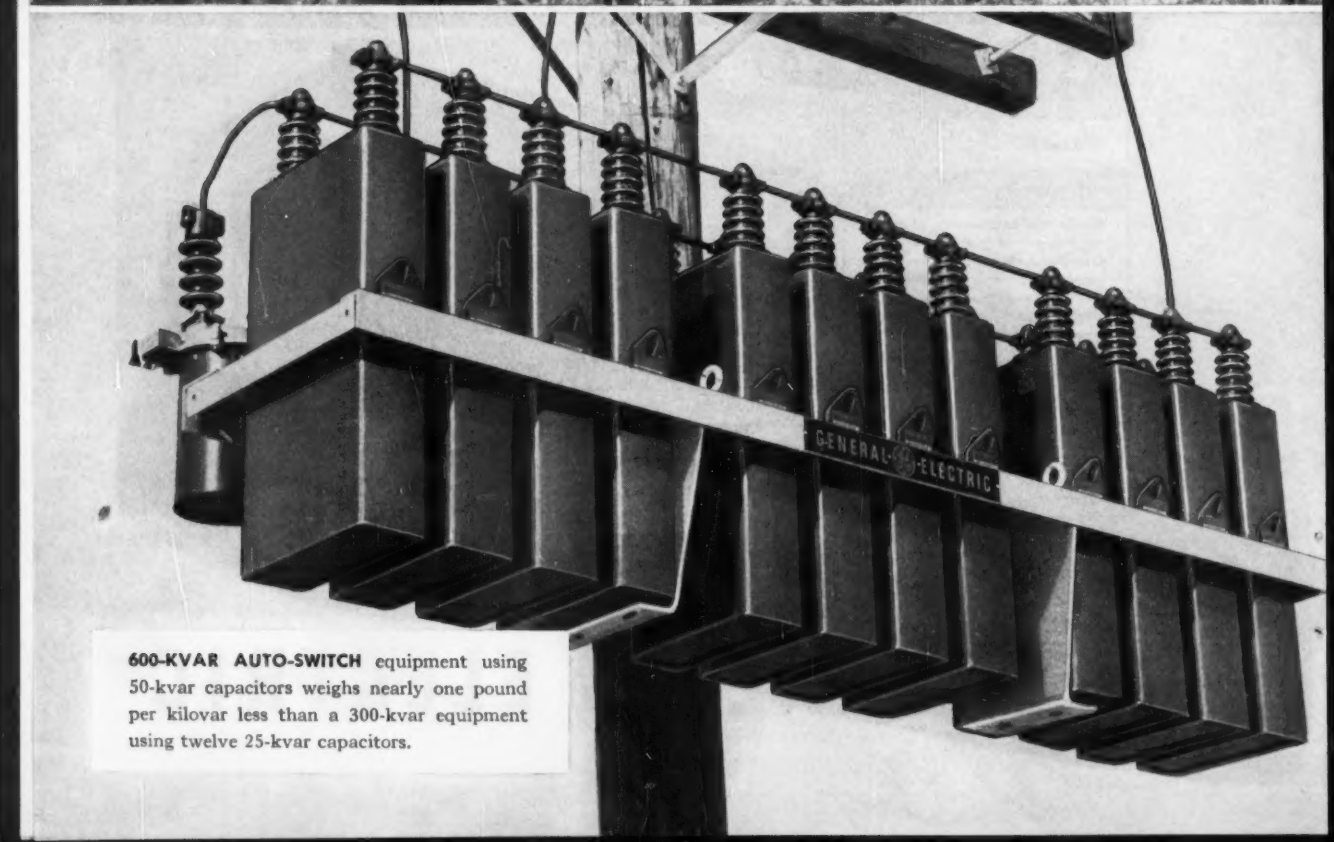
FEATURE	General Electric	Mfr. A	Mfr. B	Mfr. C	Mfr. D	Mfr. E
Production-line impulse testing	√			√		√
Nitrile rubber gaskets	√					√
One-piece clamping band	√					
H-v and l-v terminals handle both copper and aluminum conductors	√					
Strenicor pressure terminal clamps	√					
Super Melaglyp paint	√					
More than 100 warehouses	√	√				
Nationwide, company-operated service shops	√	√				

Progress Is Our Most Important Product

GENERAL ELECTRIC



450-KVAR AUTO-SWITCH capacitor equipment shows compact assembly made possible with the new General Electric 50-kvar capacitors. It is available as a completely factory-assembled unit, ready to install.



600-KVAR AUTO-SWITCH equipment using 50-kvar capacitors weighs nearly one pound per kilovar less than a 300-kvar equipment using twelve 25-kvar capacitors.

New G-E 50-kvar Capacitors Double Auto-switch Capacity

Higher rated units mean lower costs, less weight and bending moment, lower switching cost, per installed kilovar

General Electric's new 50-kvar capacitors, designed so that they have the same mounting dimensions as existing 25-kvar units, now enable you to put MORE kilovars on the pole with sizeable savings in space, weight, and cost per kvar.

More compact equipments made possible with these new capacitors can give you double the kilovars formerly available in 25-kvar capacitor equipments with little or no increase in rack dimensions. Racks are factory assembled, and are available in ratings from 2400 to 13,800 volts.

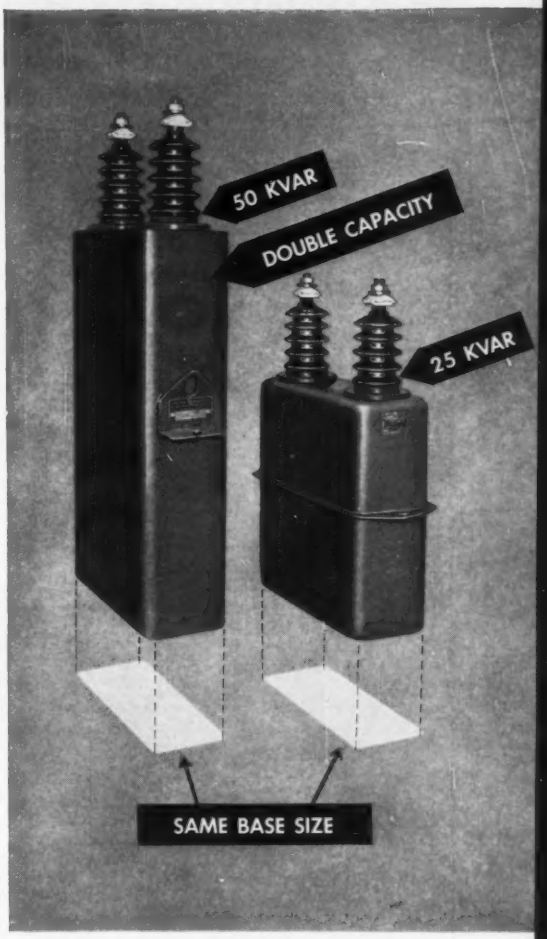
Reduced weight per kvar is made possible because one 50-kvar capacitor weighs approximately 15% less than two 25-kvar units. This results in even further weight savings in complete auto-switch equipments. For example, a single row auto-switch made up of twelve 25-kvar units weighs about 1110 lbs or 3.7 lbs per installed kvar. Use of 50-kvar units in the same arrangement gives you a pole-mounted equipment of only 2.8 lbs per installed kvar.

This 25% savings in weight per installed kvar is doubly significant. It means that bending moment on poles, an important consideration today, may be notably reduced per installed kvar by the use of 50-kvar capacitors in pole-mounted equipments.

Low kilovar costs also result from the use of 50-kvar capacitors. One 50-kvar unit costs 10% less than two 25-kvar capacitors. And, in switched equipments, switching cost can be reduced as much as 13% since a 600-kvar auto-switch requires no more switches than a 300-kvar equipment.

New features, too, have been built into the 50-kvar capacitor auto-switch designs. New neoprene switch terminal boots require no taping. Self grounding washer-head mounting screws eliminate loose parts, and provide permanent unit case grounding.

Orders are now being accepted for the new, higher rated auto-switches. The new bulletin, GEA-6485, contains full information on the 50-kvar capacitor equipments. Just contact your G-E Apparatus Sales Representative, or write to the General Electric Company, Section 441-34, Schenectady 5, New York.



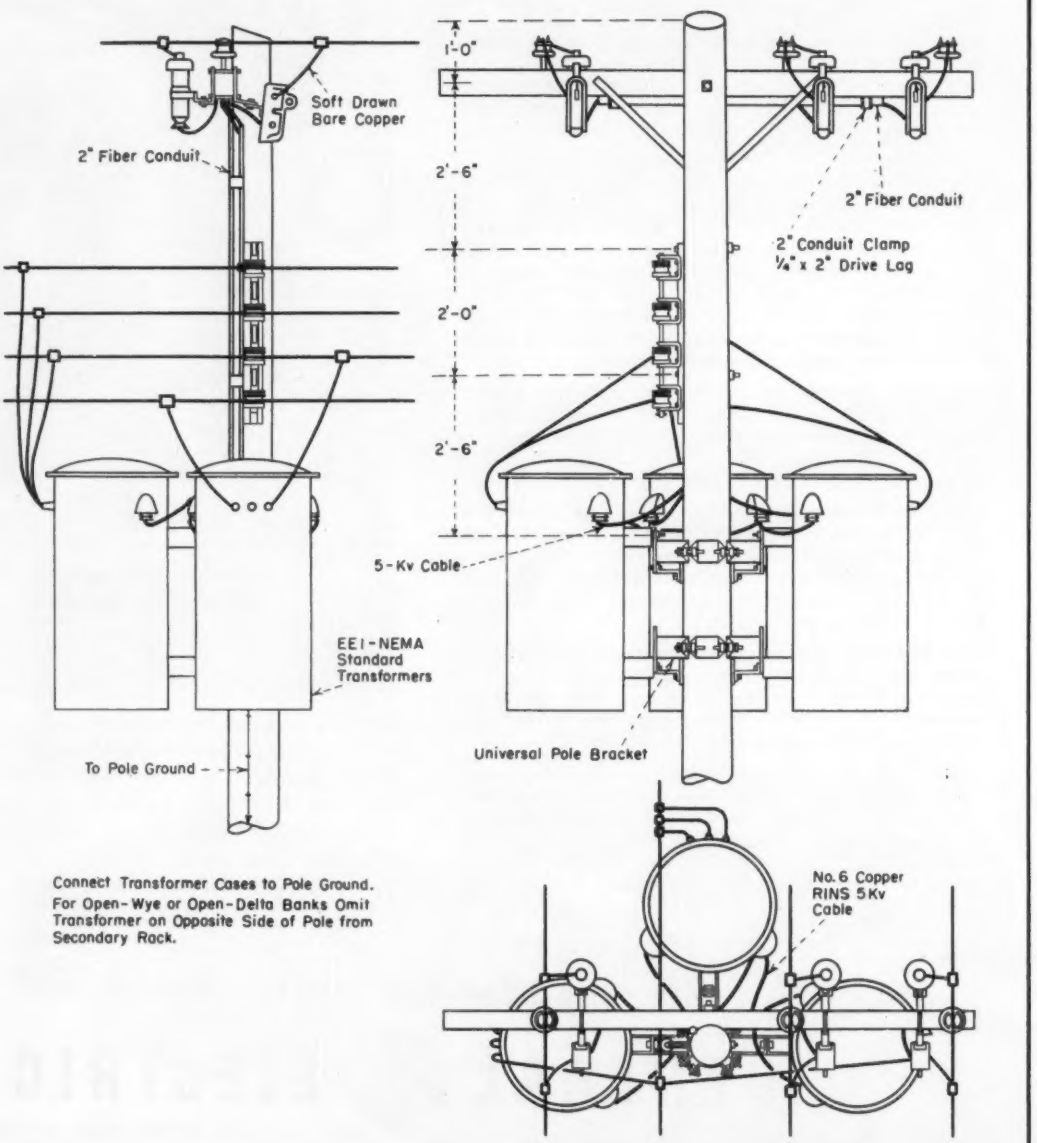
NEW G-E 50-KVAR CAPACITOR has been designed so that it will be interchangeable with existing 25-kvar units having standard NEMA mounting dimensions. Doubled capacity is achieved with an increase of only eleven inches in height over the 25-kvar G-E unit. It is available in both 5- and 8.7-kv classes.

Progress Is Our Most Important Product

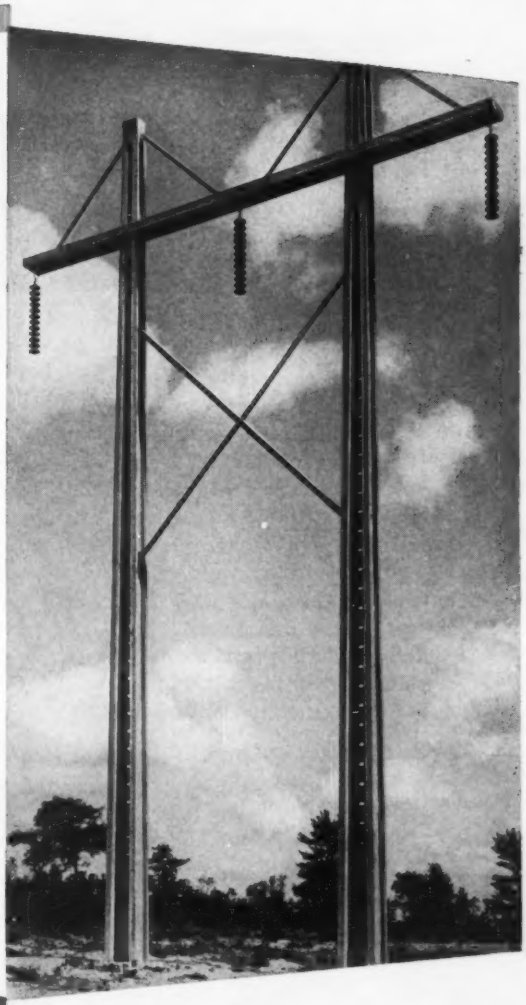
GENERAL ELECTRIC

Using Cable to Connect Primary Conductors to Transformers Below Secondary Circuit

Connections on 2.4-kv and 4-kv systems are made with 5-kv cable from primary circuit to terminals of transformers, 3-25 kva through 3-100 kva. This is an adaptation from distribution standards of Alabama Power Co.


Soft Drawn Bare Copper
2" Fiber Conduit
1'-0"
2'-6"
2'-0"
2'-6"
2" Fiber Conduit
2" Conduit Clamp 1/4" x 2" Drive Lag
5-Kv Cable
EEI-NEMA Standard Transformers
To Pole Ground
Universal Pole Bracket
No. 6 Copper RINS 5Kv Cable
Connect Transformer Cases to Pole Ground.
For Open-Wye or Open-Delta Banks Omit Transformer on Opposite Side of Pole from Secondary Rack.

Now... NEW Prestressed* Concrete Line Poles!



LONGER LIFE!
MAINTENANCE-FREE!

Rot Proof
Crack Proof
Woodpecker Proof
Weather Proof
Crumble Proof
Storm Proof
Easy to Ship and Rig
Always Available
Attractive

**Not to be confused with ordinary reinforced concrete*

On a new 110-kv power line installation from a point near Orange City, Florida, to just north of Lake Monroe, the Florida Power Corporation specified prestressed concrete line poles over all other types. Primary consideration was the exceptionally long life expectancy (50-100 years vs. an average of 15-17 years for wood poles in this area). Extremely low maintenance was another factor. In addition, there is a high degree of reliability lacking in wood pole structures of this type.

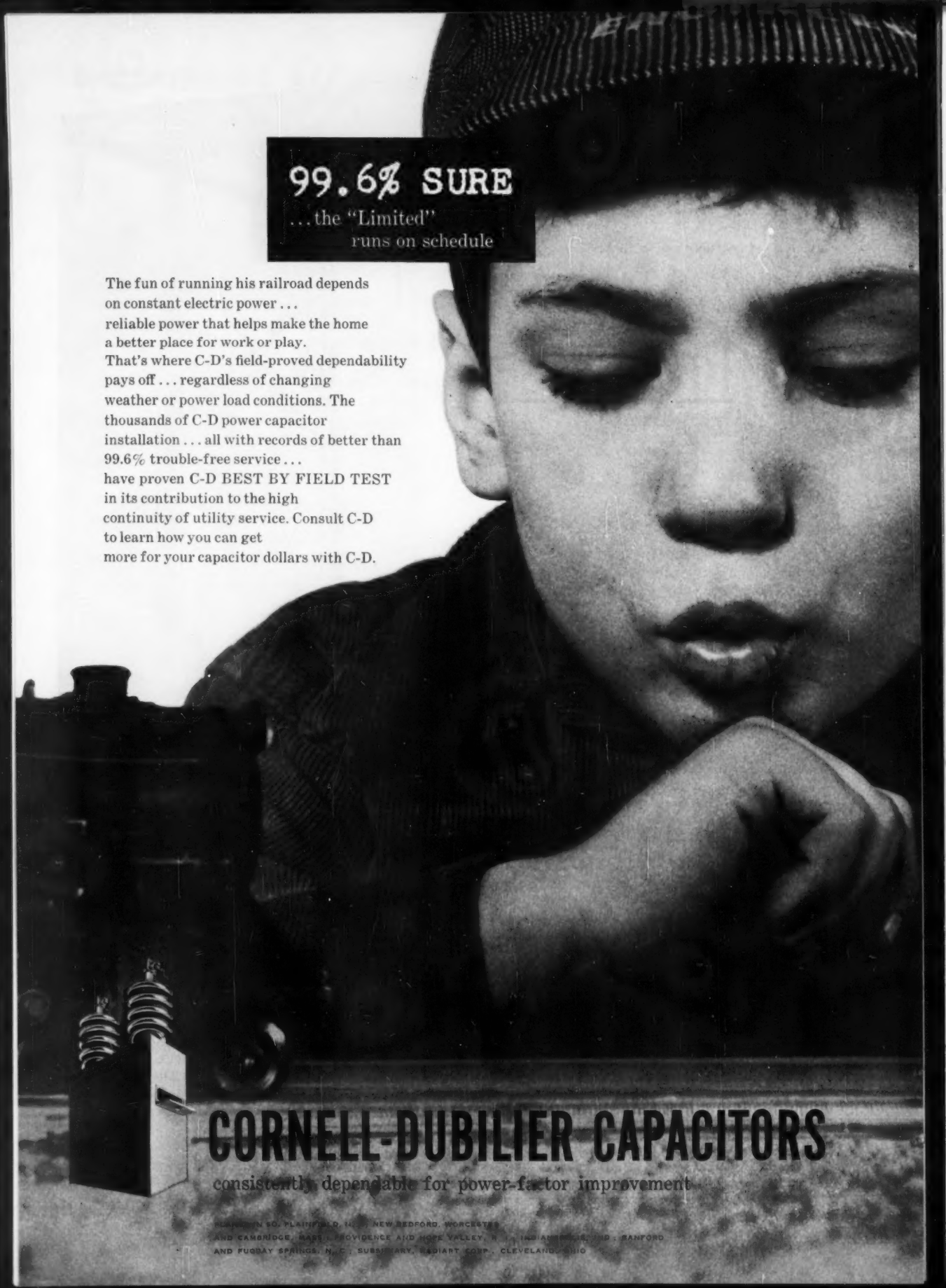
Designed and fabricated by Finfrock Industries, Incorporated, Orlando, Florida, each pole is prestressed with ⅜ in. diameter Roebling uncoated 7-wire stress-relieved strands, pretensioned and bonded to the concrete.

Easily transported and installed, the 75 ft 8 in. poles were set 10 ft in the ground, with a simple dirt backfill. Spacing of the assemblies in the line averages 933 ft – the greatest is 1400 ft. Moreover, tests indicate allowable spans of over 1600 ft.

Since prestressed concrete line poles provide so many advantages, many of which are shown above, why not investigate them for your own company? They'll save money in the long run on replacements and on new installations. For help with your specific problem write to Construction Materials Division, John A. Roebling's Sons Corporation, Trenton 2, N. J.

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation


99.6% SURE
... the "Limited"
runs on schedule
The fun of running his railroad depends on constant electric power ... reliable power that helps make the home a better place for work or play. That's where C-D's field-proved dependability pays off ... regardless of changing weather or power load conditions. The thousands of C-D power capacitor installation ... all with records of better than 99.6% trouble-free service ... have proven C-D BEST BY FIELD TEST in its contribution to the high continuity of utility service. Consult C-D to learn how you can get more for your capacitor dollars with C-D.
CORNELL-DUBILIER CAPACITORS
consistently dependable for power-factor improvement
AND CAMBRIDGE, MASS.; PROVIDENCE AND HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD AND FUQUAY SPRINGS, N. C.; SUBSIDIARY, ARIART CORP., CLEVELAND, OHIO

CORNELL-DUBILIER
power-factor
capacitors
give you better than 99.6%
trouble-free service*

C-D's power capacitor's major insulation establishes impulse levels that exceed N. E. M. A. standards. Another feature that results in longer life . . . less maintenance . . . fewer dissatisfied power-users, with Cornell-Dubilier capacitors.

C-D capacitors, although somewhat larger and heavier, have an extra built-in margin of safety to withstand occasional system high harmonic component currents.

Heavy major insulation in the form of laminated liners, with reinforced corners insures highest impulse withstand levels. It means, too, a heavier capacitor unit . . . because it's a better unit . . . but at no extra cost to you. How would you relate a slight increase in weight to years of trouble-free service?

Lowest unit dielectric stress not only provides lowest voltage gradient for steady state operating conditions, but also highest withstand protection against the transients produced by lightning, circuit breaker re-strikes and all other line surges.

Why is it that only C-D power capacitors give you assurance of complete dependability?... because C-D's built-in safety factor results from the ultimate in tried and proven design levels coupled with conservative production techniques and rigorous quality control. For catalog write to Cornell-Dubilier Electric Corporation, South Plainfield, N. J.

Typical C-D Indoor Capacitor Rack. Rated 150 KVAR; 12 KV.

Typical C-D Outdoor Capacitor Rack shipped completely assembled ready for field energization. Rated 5,400 KVAR; 13.8 KV.

*This is an average based on reports from leading utilities using C-D capacitors. Many of these reports have shown 100% trouble-free service, and none lower than 98.9%.

DISTRIBUTION—Construction

Ground Fabrication Proves Economical

D. G. FRITZ, Ohio Power Co, Lima, Ohio

Complete fabrication at ground level of American Gas & Electric's standard, two-pole, 12-ft platforms by the entire crew utilizes the potential work force efficiently.

Formerly, such assembly involved piecemeal technique. A lineman on each pole received parts singly from the ground by sheave line, and groundmen were not occupied during assembly of the 25 component parts.

Today's procedure involves the whole crew which:

1. Assembles transverse and longitudinal angle sections.

2. Squares them with tapeline across diagonal corners.

3. Installs wood planks and channels, omitting the plank between midplatform channels, or the center plank.

4. Attaches hoisting chain above the platform level and lifts the completed assembly with a truck-derrick to position on the pole-mounted supporting channels.

5. Secures platform, removes lift rigging, and installs the omitted plank and 60-in. continuous braces under the platform.

This method was tried out on the Republic-Creosote feeder-regulator station and for three transformer-bank platforms on Green and Sawyer and Ford Motor Co properties.

Advantages include:

1. The entire crew works safely on the assembly as overhead movement of pieces is minimized. This is especially important in slippery, inclement seasons.

2. The procedure saves time, expense, and fatigue.

3. Assembly takes 20 min on the ground instead of 1 hr.

4. The crew remains in a normal standing position. This is in contrast with linemen's restricted movement on poles and the assumption of a prone position for tightening plank and channel end bolts.

5. Labor cost for three linemen and two groundmen for ground fabrication averaged $3.50 per job for the instances cited—a saving of $7 per installation.

(*More How To on page* 150)

KEEP YOUR 2-WAY RADIO IN PERFECT OPERATING CONDITION

with

MOTOROLA

factory approved

REPLACEMENT PARTS

Engineered, factory inspected and *tested* to new equipment standards . . . in fact, they're the same quality parts used in *new* Motorola equipment. You're assured of dependability and long life because Motorola, the leader, stands back of every replacement part. Prices are competitive—seldom higher, often lower than prices of "garden-variety" parts. Conveniently located Parts Depots give you shipped-same-day-order-received service. Parts can also be ordered direct from authorized Motorola Service Stations.

TUBES—*Every lot statistically checked on Motorola designed and built equipment . . . characteristics maintained within limits necessary for best performance. Available singly or in convenient "ten-packs."*

VIBRATORS—*Thoroughly checked for waveform, input and output currents, voltages, and for reliable performance under widely varying conditions. Buy them singly or in the handy "five-packs."*

TUBES . . . VIBRATORS . . . CAPACITORS . . . FUSES . . . LAMPS . . . PANEL METERS . . . SELENIUM RECTIFIERS . . . RESISTORS . . . SPEAKERS . . . SWITCHES . . . and all electrical or mechanical replacement parts for mobile radio.

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Factory Approved Replacement Parts

BIG NEW PARTS CATALOG—yours FREE

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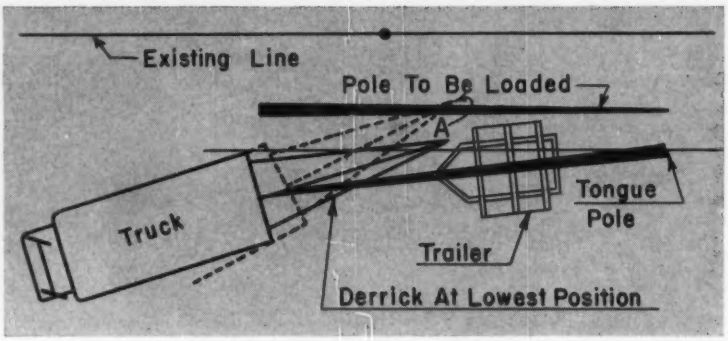
COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

TRANSMISSION—Construction



Pole Loading Is Safer, Faster

D. G. FRITZ, Ohio Power Co, Lima, Ohio

A pole trailer may be quickly and safely loaded without detaching it from a line truck which is equipped with a permanently mounted hydraulic derrick. The operation may be performed in the field or in the stockpile yard.

The trailer is pulled up parallel to the pole to be loaded until its balance point is near the trailer axle. The line truck's front wheels are turned and backed with the derrick in its lowest (horizontal) position until the derrick head is over the balance point of the pole to be loaded. After the pole has been raised sufficiently to clear the trailer bed, the truck wheels are cut in the opposite direction and moved to swing the load over the trailer.

When the balance point of the pole is farther from the butt than the distance between the derrick head and trailer-tongue attachment, additional "hooking" is needed to obtain an acceptable trailer-load balance.

This technique eliminates the physical manhandling usual with pole skids, winch-line, and snatch-block rigging. Moreover, maximum safety is assured during inclement weather when poles are difficult to handle in usual way.

GENERATION—Construction

'Copter Scouts And Hauls at Hydro Project

Site exploration and hauling of equipment are being speeded at the Muddy hydroelectric project in the high Cascade Mountains of southwestern Washington, thus enabling Pacific Power & Light Co to meet equipment and crew transport schedules.

In 4 minutes, the helicopter hauls pipe and other drill gear across deep canyons and ridges that would take 4 hr to traverse by the usual trail pack animals.

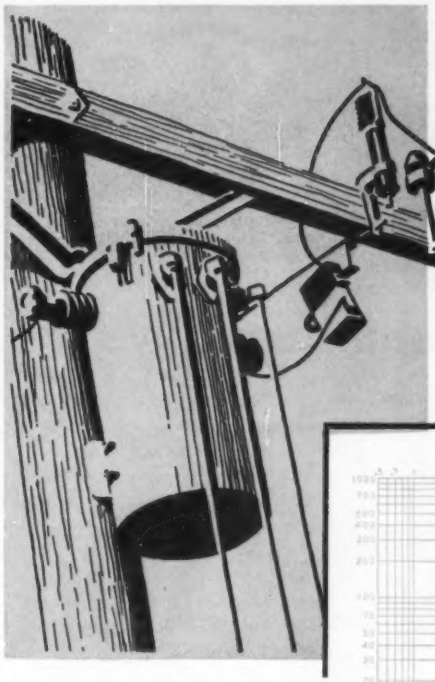
The rugged canyon area of the upper Lewis River basin is the site of the fourth stage development of the Columbia River tributary. PP&L has two power dams in operation, the 100,000-kw Merwin and the 133,000-kw Yale, and is now engaged in the joint development of the Swift site's 256,500-kw potential with Cowlitz PUD. It also proposes to investigate the high-mountain storage possibilities of a fifth area known as Meadows.

Heliports Set Up

The Lewis River drains a region west and south of two Cascade peaks, snow and glacier-clad Mt. Adams and Mt. St. Helens.

PP&L slashed two heliports out of the wilderness to accommodate the helicopter. One, dubbed Muddy International Airport, is four large air drums supporting two troughs from which the helicopter plucks it cargo. Alder logs flung across the swampland at the river's edge form the site terminus.

(*More How To on page* 152)



NOW...

full overload capacity transformer protection

without unnecessary outages

NEW CHANCE SloFast Fuse Links

follow the Safe Loading Curve

DUAL ELEMENT

SLOW

FAST

The Chance SloFast Fuse Link has two distinct current responsive elements: A slow element, made up primarily of a heater coil and soldered junction with insulated strain pin and ceramic tube; and a fast element constructed like the single element in a conventional fuse link.

This exclusive Chance development gives more accurate, more positive overload capacity protection for distribution transformers than you could ever before obtain.

New Chance SloFast Fuse Links offer 3 advantages over the conventional type: full use of available transformer overload capacity without reducing transformer life . . . virtual elimination of transformer "burn-outs" due to overloads and secondary faults . . . increased continuity of service to your customers.

These fuse links are available in both universal buttonhead and open link styles in a complete range of sizes from 0.2 to 10.4 amps inclusive. All SloFast Fuse Links have ampere ratings identical with the full load ratings of the transformers they are designed to protect. Each fuse link comes in an individual container clearly labeled to show rating. Chance SloFast Fuse Links are sold by leading Electrical Wholesalers everywhere.

Write to A. B. Chance Company, Centralia, Mo., for new bulletin "FUSE LINKS AND HOW TO USE THEM." It contains performance curves and application tables for all distribution voltages.

PACKAGED FOR EASY REMOVAL

Linemen can remove links from containers without removing their gloves. A slight, firm twist separates the unit container from the 5-unit container. The end of each unit container is perforated for quick removal of the link.

A·B·CHANCE CO·

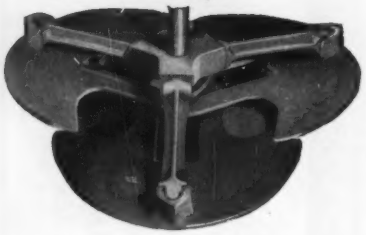
ABC INDUSTRIES

CF56-20

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life



● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

Exclusive Everstick nut housing Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO
FAIRFIELD, IOWA

Dual-Duty Suburbans Save

JOHN P. McDERMOTT, Working Foreman, Garage, Appalachian Electric Power Co, Lynchburg, Va.

Two suburban cars in this district have been equipped by Appalachian Electric Power Co for speeding the replacement of broken poles and the construction of new branch lines. They have been equipped with a roof rack for two sets of digging tools, a canister for hot-line sticks, and a trailer hitch on the rear bumper.

This equipment enables part of a line crew to proceed immediately to the work site while the remainder of the line crew, using a line truck, picks up the necessary poles and hardware from the storeroom and pole yard. A "suburban" crew can get to the site of a broken pole more quickly to clear the pole and wires. Often it has the hole ready for the new pole by the time the rest of the crew arrives.

Truck Can be Left on Job

When a sizeable job, taking several days, is under construction 50 to 60 miles from the garage, storeroom, or district office, the suburban with its trailer hitch serves still another purpose. At the end of each day, it hauls the crew of the line truck and its empty pole trailer back to operating headquarters. The line truck can be left locked at the job site overnight where it is needed for the next day's work, and the crew can return next morning using the lighter suburban car.

The Lynchburg district operates 1,733 miles of pole lines, including rural lines. In purchasing line-truck bodies, $541 can be saved by using a standard body instead of one with a crew compartment. On both normal and emergency work, involving pole setting, the foreman takes the majority of the crew directly to the job in the suburban. The line truck picks up the necessary poles. When the line crew is held on a job until quitting time, all men except the truck driver and a helper can be carried to headquarters in the suburban. This saves overtime for the major portion of the crew.

On preventive maintenance work, the large line truck can be kept on the main roads, and the suburban used on minor roads and for locations not readily accessible to line trucks.

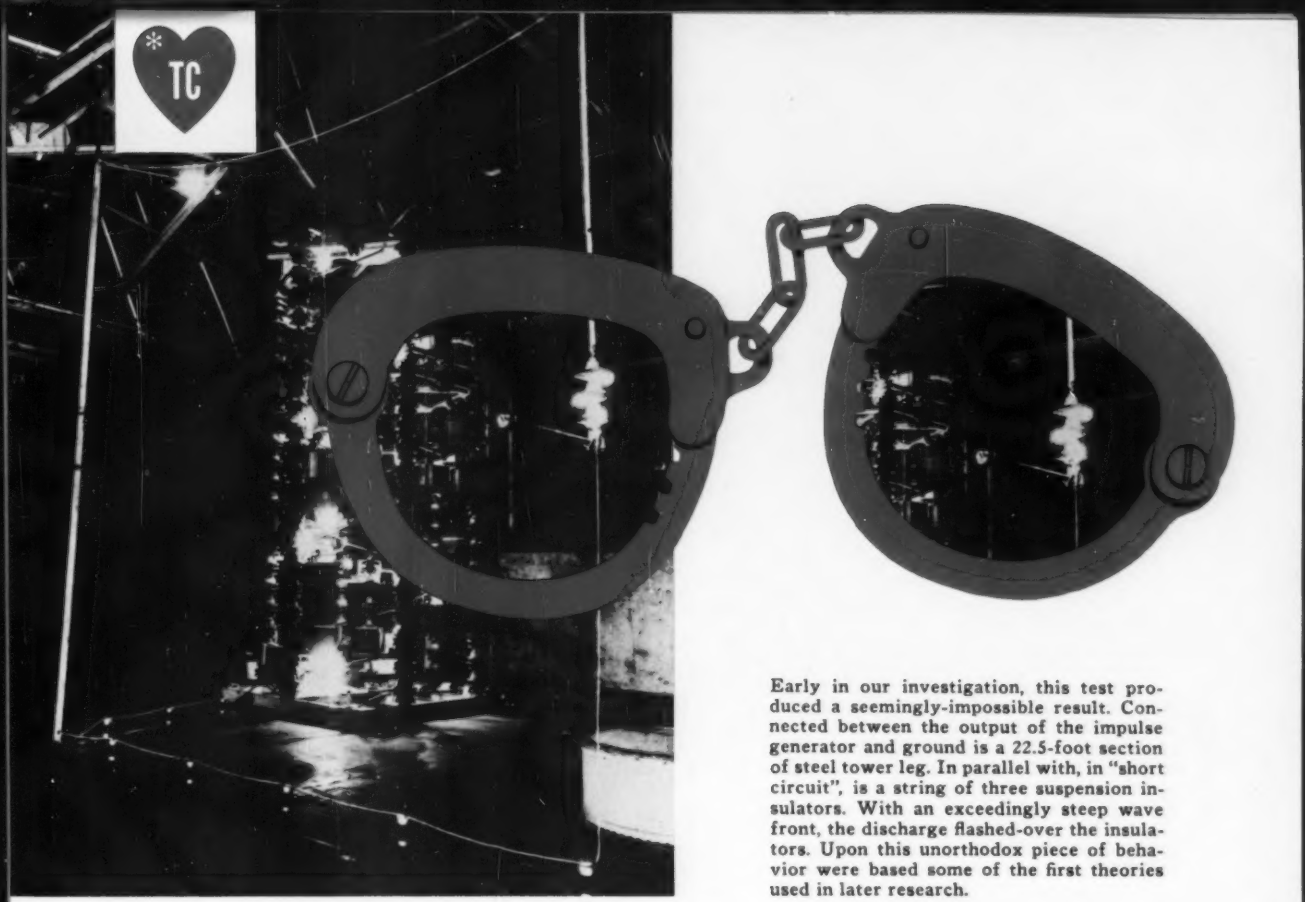
Equipped with Radio

Suburbans are equipped with radio communication. They can patrol lines quickly and perform switching operations in conjunction with line-truck operations. According to time studies, an annual saving of $6,000 in the payroll can be effected by using a

suburban for transporting line crews working in the rural area. Total operating cost of a suburban, traveling 9,000 miles a year, averaged less than $750, including fixed charges. This makes a net annual saving in excess of $5,000.

A time study made last July showed that 162 man-hours were saved in ten work days when the suburban carryall worked with rural line truck.

(*Continued on page* 157)



Early in our investigation, this test produced a seemingly-impossible result. Connected between the output of the impulse generator and ground is a 22.5-foot section of steel tower leg. In parallel with, in "short circuit", is a string of three suspension insulators. With an exceedingly steep wave front, the discharge flashed-over the insulators. Upon this unorthodox piece of behavior were based some of the first theories used in later research.

We've CAUGHT lightning in the act of making trouble

HIGH VOLTAGE LABORATORY RESEARCH REVEALS LITTLE KNOWN COMPONENTS OF LIGHTNING THAT ACCOUNT FOR EXCESSIVE OUTAGES ON EXTRA-HIGH-VOLTAGE TRANSMISSION

Why must we "slice time so thin?" Why is it necessary to isolate an element of only 1/100-millionth of a second from a complete event lasting about 1/10-millionth of a second? Granted, it may be a neat trick, but is it worth the trouble?

It is part of one of the biggest power transmission laboratory research projects we, or anyone else, ever tackled. Extra-high-voltage lines are being built or planned all over the country. Nothing is too good for this kind of construction. Its performance should be superb. Yet, some lines that have gone into service show excessive lightning interruptions, many times the level assumed in design and, mysteriously, many times the rate experienced on lesser lines in the immediate vicinity. Such a problem is *worth* a bit of trouble.

Our laboratory is exploring virgin territory far beyond the textbooks. Part of this research deals with ultra-steep impulse waves heretofore not produced, controlled, or evaluated under any organized program and, in general, not well understood.

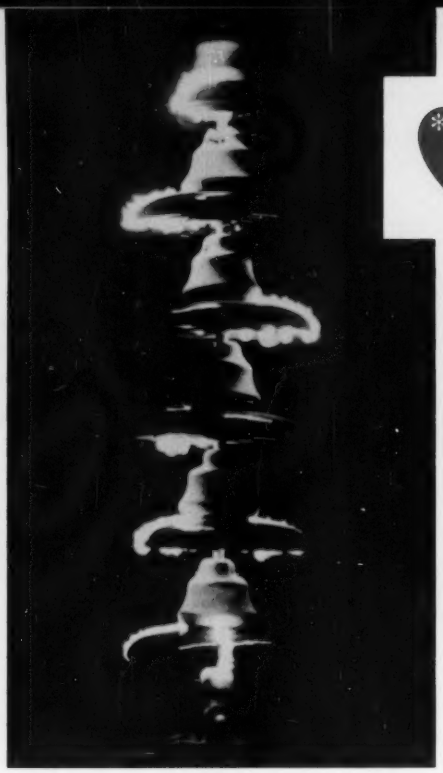
The equipment, manpower, and technical knowledge necessary for such advanced study was at hand in the O-B High Voltage Laboratory. Here, for nearly 40 years, men have developed insulation and conducted far-sighted research pointed toward product improvement, and the solution of new transmission problems.

This application of Technical Competence in the highest order has a broad interest as well as a specific value.

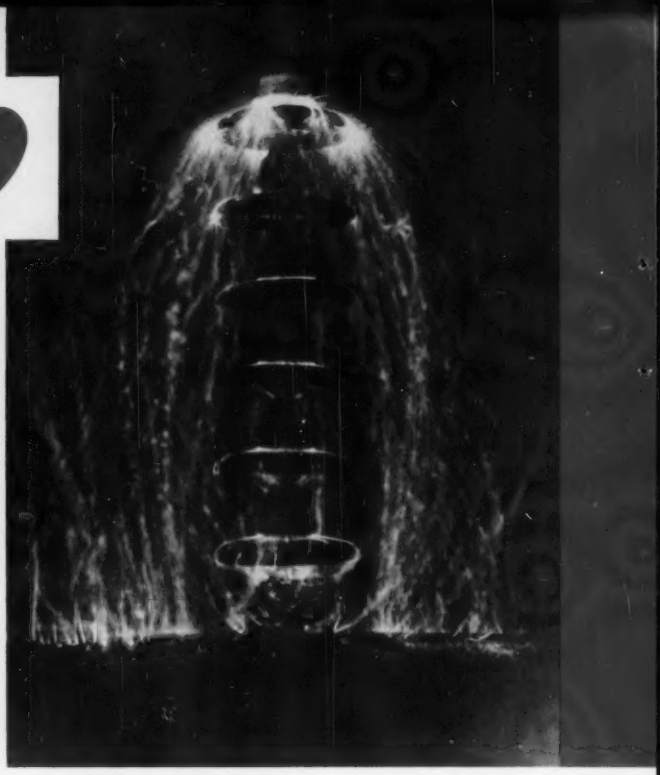
TECHNICAL COMPETENCE—THE HEART OF EVERY OHIO BRASS INSULATOR

Ohio Brass

WILL YOU PLEASE
TURN THE PAGE
FOR MORE OF THIS STORY



In approximately 1/10-microsecond, and at a wave-front in excess of 8,000,000 volts per microsecond, this "skin-tight" flashover occurs. It is notable for its peculiar tendency to hug all surfaces of the insulator string -- even following the contour of the underside petticoats. This is in sharp contrast to slower, more conventional impulse discharges which tend to spring clear of the string through the surrounding air. This fact is typical of the many new elements that have helped develop an entirely fresh concept of insulator application.



Let us go a step ahead of the discharge shown at the left -- a short step, certainly, consisting of only 1/100-millionth of a second prior to the flashover shown. Here is the condition of the insulator string in this brief preceding instant. It is difficult for some people to believe that such a field can exist, let alone be recorded. Obviously, this can have a profound effect on insulator behavior. Bear in mind, this is not some academic laboratory trick. It is one of the conditions, heretofore generally unrecognized, contributing to the unpredictable lightning performance experienced on transmission systems. Note how incipient flashover is well-developed on some of the units. Voltage applied here has reached approximately 95 per cent of the flashover value.

WHAT HAPPENS $\frac{1}{100}$-MILLIONTH OF A SECOND BEFORE A $\frac{1}{10}$-MILLIONTH-SECOND FLASHOVER?

Fractional-Microsecond, Pre-Flashover Lightning Behavior Is Now Being Recognized and Evaluated

Voltage on a transmission tower caused by lightning discharge has usually been viewed in terms of crest lightning current multiplied by tower footing resistance. This now may be regarded as the climax of a series of previous events. Prior to such a time, and long before the crest is reached, lightning current runs down the tower and is reflected back to the tower top. This action involving only a portion of the rapidly-rising lightning wave occurs in a small fraction of a microsecond. Its severity is a function of tower height as well as the characteristics of individual lightning strokes. As towers have become taller in extra-high-voltage construction, "something" has been added, however, which aggravates the condition. This has been found to exist on all lines, usually to a lesser degree, but probably accounts for many of the "unexplained outages" contained in most operating records.

Investigation of this phenomenon calls for extremely steep-wave test voltages, and necessitates working with very brief increments of time. We have now attained high voltage impulse wave fronts with a rise greater than 8,000,000 volts per microsecond -- at least twice the generally recognized wave front of lightning. These are now subject to routine production in the laboratory along with full control, oscillographic recording, and measurement.

As a result of these investigations, progress has been made toward a better understanding and a reduction of this class of lightning interruption. A great deal of further research still lies ahead.

A much more detailed discussion is contained in AIEE Paper 56-201, "Anomalous Flashovers on Transmission Lines" by C. J. Miller, Jr., Ohio Brass Company. This paper was presented before the Winter General Meeting, Jan. 30-Feb. 6, 1956. Copies may be obtained by writing us.

How you can use this research

Going down from extra high voltage transmission, experiments have been made in the laboratory at lower voltage levels with similar findings. These two photographs show a wave front of 8,000,000 volts per microsecond applied to a 4-piece pintype insulator as used on heavy 69-kv lines. In the flashover, note again the tendency for the discharge to follow contours of the porcelain instead of jumping clear. The second picture shows the fractional-microsecond, pre-flashover corona condition at approximately 95 per cent of flashover voltage, and 1/100-millionth of a second prior to flashover. While the development of generation and recording techniques for these steep-wave investigations was initiated by problems in the extra-high-voltage field, this area of research extends over all operating levels.

For the past year in the O-B High Voltage Laboratory, a major share of research time and facilities has been devoted to various phases of power transmission as high as 500 kv. Primarily, this includes lightning disturbances and their control on extra-high-voltage systems, and exhaustive investigations of multiple or "bundle" conductors.

From this work has been derived a mass of data and technical background on new transmission developments that is presently unequaled. This information is freely available to planners and designers of new high-performance transmission systems.

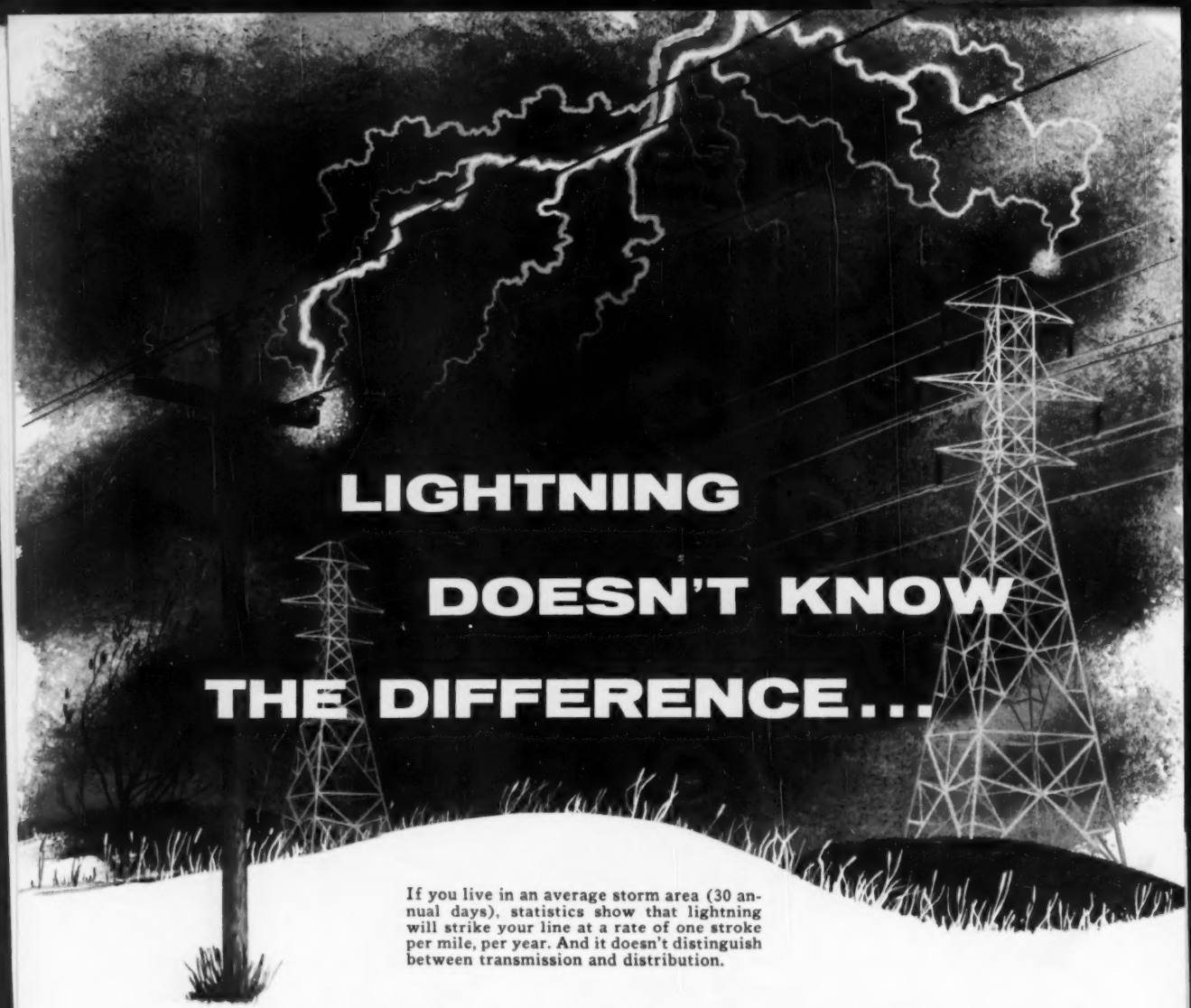
-- and remember this: The equipment and personnel capable of conducting basic research on such a scale as we discuss here are part of a laboratory that has been an organized institution for almost 40 years. It has grown to become the finest of its kind. In addition to the somewhat "glamorous" projects like the one we illustrate, it has made priceless contributions throughout the years to product development, processing, and the maintenance of performance standards. It is the mainspring of Technical Competence, the heart of every O-B insulator.

Ohio Brass

MANSFIELD OHIO, U.S.A.

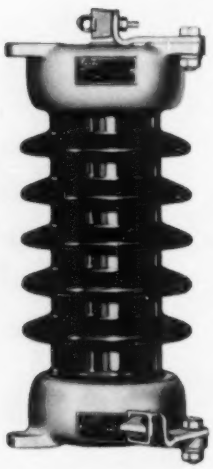
IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

TECHNICAL COMPETENCE—THE HEART OF EVERY OHIO BRASS INSULATOR



LIGHTNING DOESN'T KNOW THE DIFFERENCE...

If you live in an average storm area (30 annual days), statistics show that lightning will strike your line at a rate of one stroke per mile, per year. And it doesn't distinguish between transmission and distribution.



Has High Cost Kept Arrester Protection Off Your Primary Distribution? Then Investigate The Thorex

To lightning, all lines look alike. But some are better protected than others. High voltage transmission has good shielding, efficient grounding, and the best arresters at stations. Primary distribution, in the range of 22 kv and below, seldom enjoys such privileges, however. Yet these are the pipelines to your customers.

Once, it was not economic to equip such lines with arrester protection -- it was either too costly or ineffective. Today it's different. Today, a lightning arrester at "rock-bottom" price, the Thorex GP, passes every standard requirement for first class station application, and is materially better than any arrester on the market just a few years ago.

Now, you *can* install arresters on the lines that actually deliver your power. See how inexpensive it is with the Thorex -- inexpensive, but the best you can get!

Ohio Brass

MANSFIELD OHIO, U.S.A.

4650-H

Suburban Save

(*Continued from page* 152)

In one instance, a line crew, finishing the day's work 30 miles from Lynchburg, was dispatched to handle storm damage. Five men returned to Lynchburg with the truck, while the foreman and three men spent 7 hr overtime work in the trouble area, using the suburban. Man-hours saved were 61.

Patrol of a 44-kv line which would have taken the line truck 3½ hr, was accomplished by the suburban in 1½ hr. The suburban crew also refused a line transformer, thus saving a 42-mile round trip for a troubleman. In all 24 man-hours were saved.

Fabrication and installation of the suburban rack cost $36.70, including labor and materials. Cost of the trailer hitch was $48.45 installed.

GENERATION—*Maintenance*

Expedient Stops Hydrogen Leak

DONALD E. SYLER, Ohio Power Co, Beverly, Ohio

More than 80 cu ft of hydrogen was being lost each day through a leak in the welded joint in the main hydrogen supply line to a generator casing.

Various remedies — electrical scotch tape, gauze coated with lacquer, hose clamps, etc.—were tried unsuccessfully. Peaning of the leak was impracticable because of its inaccessibility and particularly because of the potential fire and explosion hazard.

It appeared that the leak could be stopped only by shutting down the unit and purging the hydrogen lines, as no valve existed between the leak and the generator.

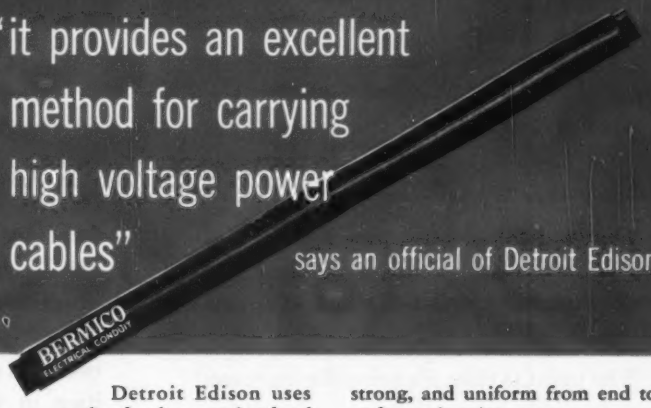
An expedient was adopted until the leak could be permanently repaired while the unit was down for other purposes.

A piece of soft sheet lead was clamped against the leak by two pieces of flat steel stock drawn tightly together by ¼-in. bolts at the ends. The pressure seated the soft lead over the leak, so that a perfect seal was obtained for several months.

Such a seal could be easily adapted to other leaks. The clamping device was fabricated from scrap material and installed in less than 2 hr.

BERMICO® electrical conduit is used by Detroit Edison because...

"it provides an excellent method for carrying high voltage power cables" says an official of Detroit Edison



Detroit Edison uses carload after carload of Bermico Conduit to carry high voltage cables supplying continuous power to the automotive center of the world.

Made to precision standards from cellulose impregnated with coal tar pitch, Bermico Conduit is alkali-resistant, acid-resistant, strong, and uniform from end to end—yet low in cost.

Leading electrical contractors and public utilities everywhere are getting the maximum protection and ease of installation that it provides. You can, too, by always specifying Bermico Conduit. Immediate shipment of all sizes and fittings guaranteed.

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A question for every electric utility

CAN LOAD GROWTH BE HANDLED WITH LOWER INVESTMENT COSTS?

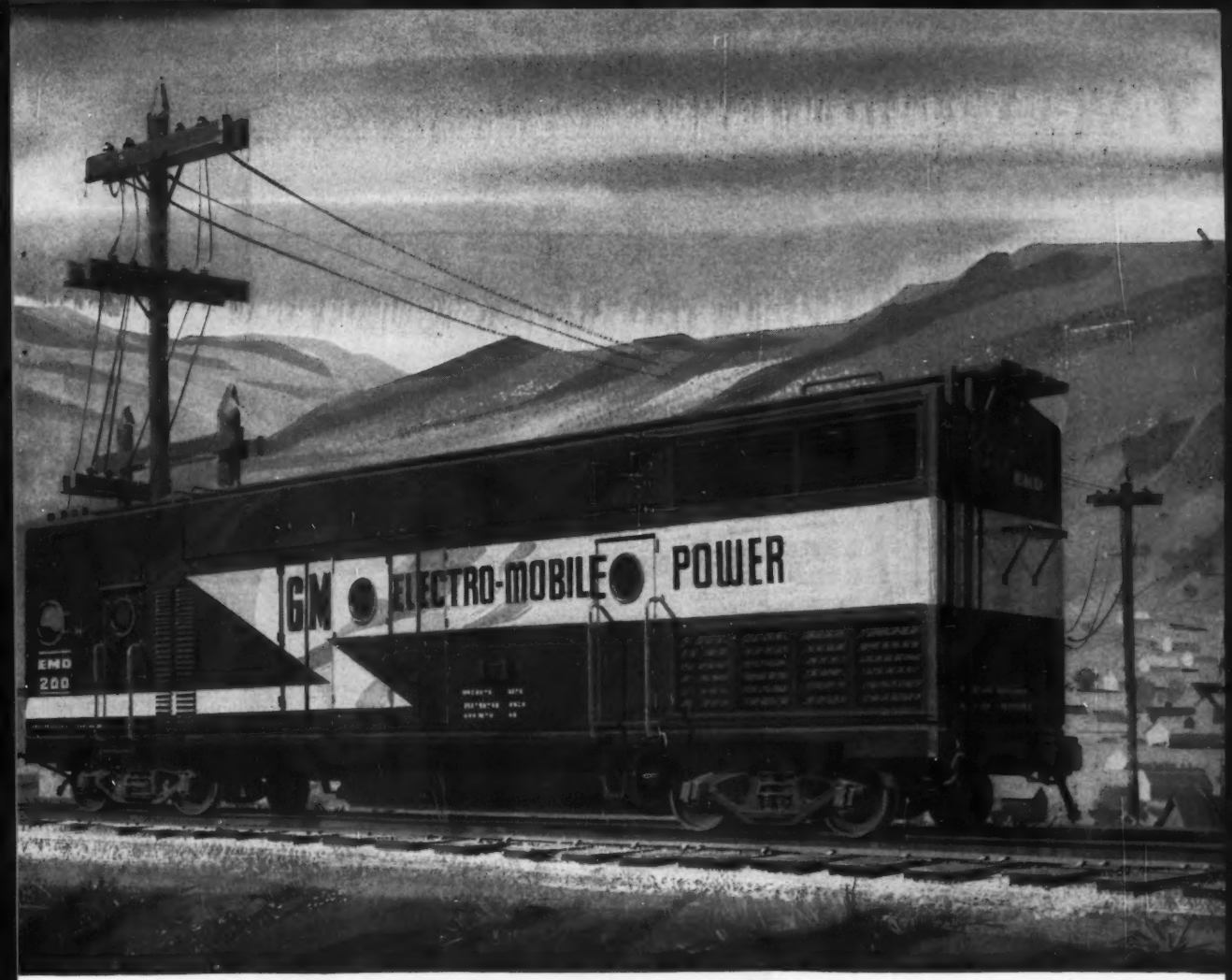
Our unequivocal answer to this question is, "Yes . . . and with greater power flexibility too."

Demand for electric power cannot always be controlled. Today's budding load growth area may well fall short of tomorrow's expectations.

The point is this: planning for increased power facilities necessarily precedes potential requirements by two to three years. Must, that is, unless a method can be devised that will permit the economic employment of units of power to handle load requirements as they develop, thus permitting a more realistic, longer-range selection of site and size for permanent installations.

Electro-Mobile Power provides the base for just such a program. It can be moved from one load center to another. It can be used in multiples to handle either building or diminishing demand. In short, it can follow the demand until such time as it becomes economic to build permanent facilities in the most advantageous location.

Can load growth be handled with lower investment costs? We think joint analysis of your own growth plans is the shortest way to an affirmative answer. Let's discuss it. Contact your nearest Electro-Motive representative for details.



As demand increases in the load growth area, Electro-Mobile rail units like this can be added or subtracted in 1000 kw increments to match power requirements exactly, at lowest cost. After demand has been established, permanent facilities can be erected in the most economical and desirable location. Electro-Mobile units offer the most advanced electrical engineering, equipment and controls. Rail units may be placed on sidings as shown here or mounted on piers for semi-permanent use.

Electro-Mobile trailer unit is remarkably adaptable to many temporary uses because of its quick mobility. Trailer units have 500 kilowatt capacity.

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS
LA GRANGE, ILLINOIS

Sales Offices in Chicago, New York, St. Louis, San Francisco

Electric Molder Key To Precision Castings

CLYDE JONES, Industrial Power Engineer, West Penn Power Co, Washington, Pa.

Precise, smooth-faced castings are now in mass production at the Washington Mould, Machine and Foundry of Washington, Pa., since the installation of a new, electric shell molder. An automatic timing feature provides molds of any desired thickness. The fine degree of temperature control inherent in electric heating produces high quality molds which minimize machining time on the resulting castings.

The electric molder is a double-ended machine, permitting the operator to work on two patterns at the same time. At each end of the machine is a receptacle called the dump or investment box which holds the sand and phenolic resins used in making the molds. Other component parts include two separate mold pattern holders and an electrically heated, movable oven, which may be used with either of the two pattern holders.

Both halves of a mold are made in a single pattern. The power rating of the pattern holder is determined by the size, thickness, and intricacy of the mold design and may run as high as 48 kw.

After the dump box at each end of the machine has been filled with sand and phenolic resin, the operator presses a button and one of the mold patterns is swung over to cover the adjacent dump box. The pattern and box are then inverted, despositing the sand and the resin on the heated surface of the mold pattern.

The dump box inversion time determines the thickness of the mold obtained. At the end of the predetermined inversion time, the pattern holder is automatically returned to its original position and the 20-kw baking oven is rolled over the mold to bake it. Meanwhile the operator starts the second mold in the box and pattern holder at the other end of the machine.

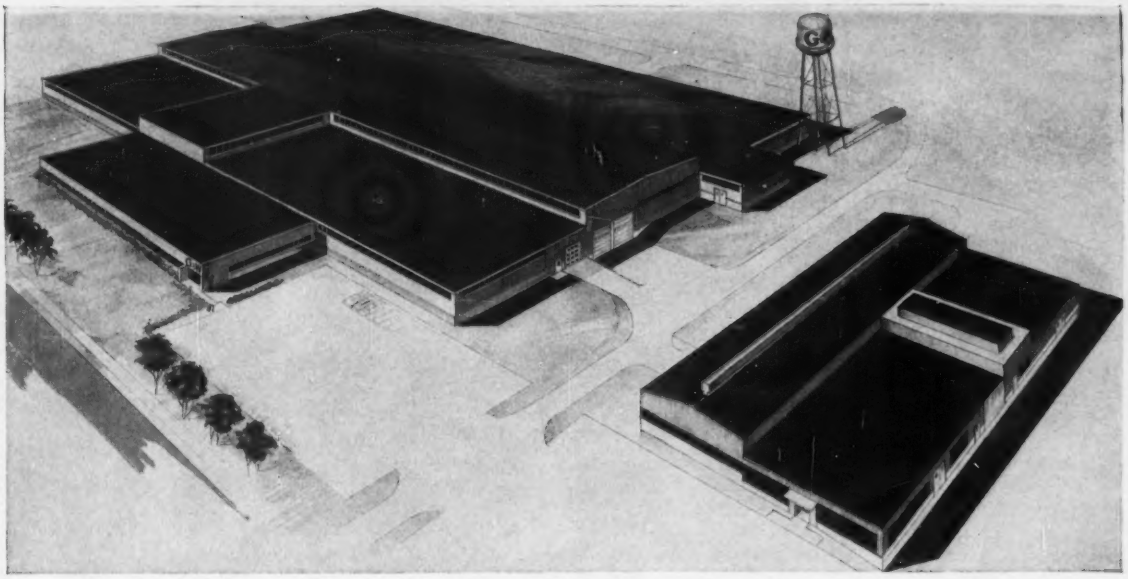
After the mold has been baked, the operator separates the two halves of the mold, fits one against the other, and seals them together under pressure.

The electric molder was installed to facilitate the production of molds of controlled quality which, in turn, make possible the production of uniform castings. The accurate, smooth-faced castings and the accompanying savings in time, machining and metal are major factors in making the electric molder profitable for the foundry.

Electric molder mass produces uniform, accurate molds of any desired thickness Clean molds insure smooth faced, precision castings, with less machining

Electric Vulcanizing Cooler Job

Four electric vulcanizers, rated at 3.8 kw apiece, have been installed at the Finnical Tire Co, Crystal City, Mo. Thermostatic controls hold the machines at a steady temperature throughout the 70-min curing cycle. Electric vulcanizers operate at cooler temperatures, require less maintenance than comparable steam systems. Robert E. Enkelmann, Industrial Engineer, Union Electric Co, St Louis, Mo.



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with increased production facilities to give you BETTER SERVICE on cable accessories

Your orders have made this move possible and we appreciate your business.

To better take care of your requirements for our products, we built this larger factory on a new site which has plenty of room for expansion.

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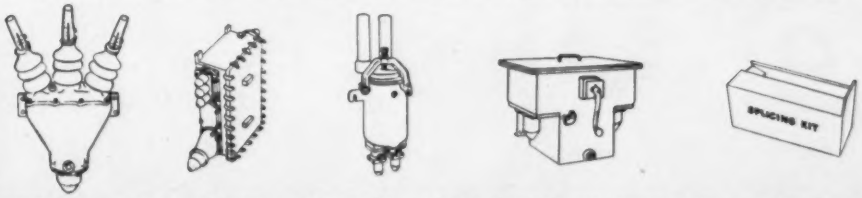
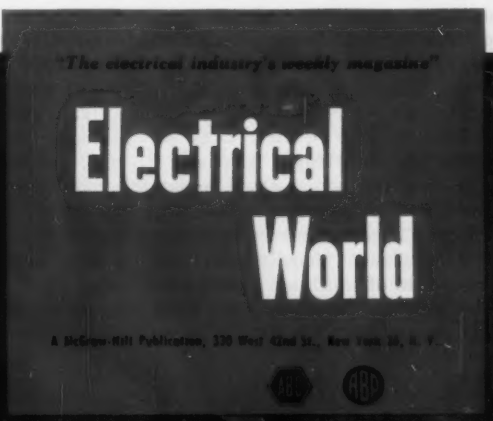


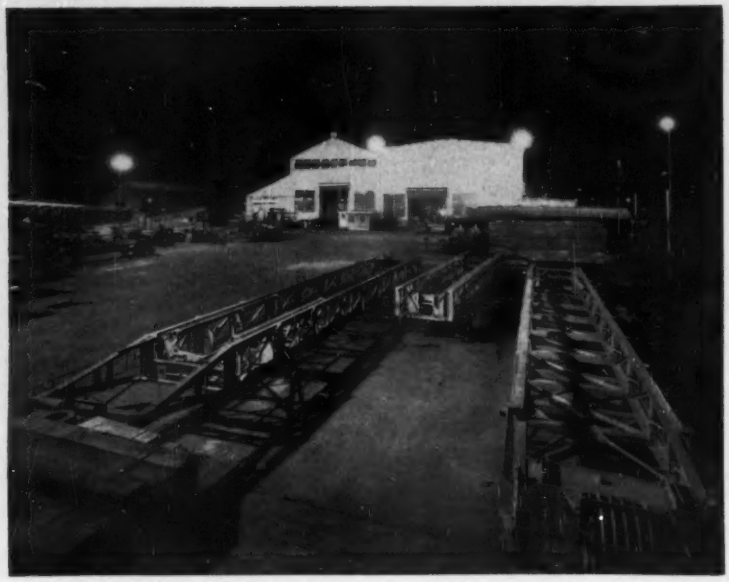
POTHEADS...CABLE BOXES...OIL FUSES...LOAD BREAK OIL SWITCHES...SPLICING KITS

Three cablemen of the Long Island Lighting Co.
"put power underground" with installation of 138-kv. copper-shielded,
paper-insulated cable in oil-filled pipe connecting
Barrett Generating Station and Newbridge Road Substation.
Photo by Robert Yarnall Richie.

What one magazine in the electrical world matches the quality of your own product?

A leader, in your business or ours, is constructively restless. He anticipates new consumer needs. Persistent product improvement is his religion. Finding new and better ways of doing things is instinctive. We speak with first hand feeling, for this has always been our state of mind, and much has been happening here at Electrical World. "Special Editorial Reports," for instance. Improvements in statistical reporting — another. Interesting new features, too . . . the "Electrical Business Outlook," the popular "Your Business," the now-regular "Live Better Electrically" feature. The *new* 1957 Model Electrical World won't have drastic body changes, but under the hood there's lots more than first meets the eye. So much, in fact, that with the January 7th issue, we go on *a regular weekly cycle,* with a completely balanced "news-technical-information" reader service. And with it, inevitably, a sharper sales tool for you.





TEN NEW MERCURY VAPOR FLOODS quadruple illumination level in this 3-acre assembly yard. Smooth, even lighting facilitates night work, cuts safety hazards

Floods Boost Outdoor Lighting 300%

W. F. WILSON, President, Wilson Electrical Equipment Co, Houston, Texas, and

ROBERT LaFLEUR, Works Manager, Ideco Div, Dresser Equipment Co, Beaumont, Texas

A tricky lighting problem at the Beaumont, Texas, plant of Dresser Equipment Co's IDECO Division was resolved by using a new type of mercury vapor floodlight. Existing lighting facilities in a 3-acre outdoor area, where large drilling rigs and equipment are assembled and tested, were inadequate.

The original 10-kw installation, fourteen 500-w and two 1,500-w incandescent floodlights, covered less than half the desired area and produced an illumination level too low to permit close inspection and adjustment of equipment without using portable lighting. As the plant's electrical system was operating at near capacity, additional incandescent floodlights could not be installed.

The new floods include a "color improved" mercury vapor lamp and a new style reflector, designed to prevent losses normally caused by "trapping" light behind the bulb. The new installation includes ten 1-kw units, eight of which are mounted on 25-ft poles in the center of the work area and operated directly from the 440-v line. Two additional units, mounted on the plant roof, 50 ft above the ground, operate at 220 v. Plans call for raising the pole-mounted units to the 50-ft level. An eleventh unit, mounted on a mobile crane can be used in unlighted areas.

Cost of installing the new fixtures was approximately half the estimated cost of adding more incandescent units, even if the additional load could have been accommodated. Illumination level was increased 300% from 3 to 12 ft-c, with only a 9% increase in load. The new units will last longer than the incandescents, thus saving replacement cost and labor.

An additional benefit derived from the new floodlights is the increased safety in the fringe areas of the yard where extra materials are stored. Because at low levels of illumination the human eye is more sensitive to the shorter wavelength colors produced by mercury vapor than to the lower frequencies of a conventional incandescent, workmen now can move freely among the stored material without the danger of tripping over unseen objects. Current plans envision a ⅓ reduction in the lighting fixtures machine shop, by substituting the new floods for the present incandescents.

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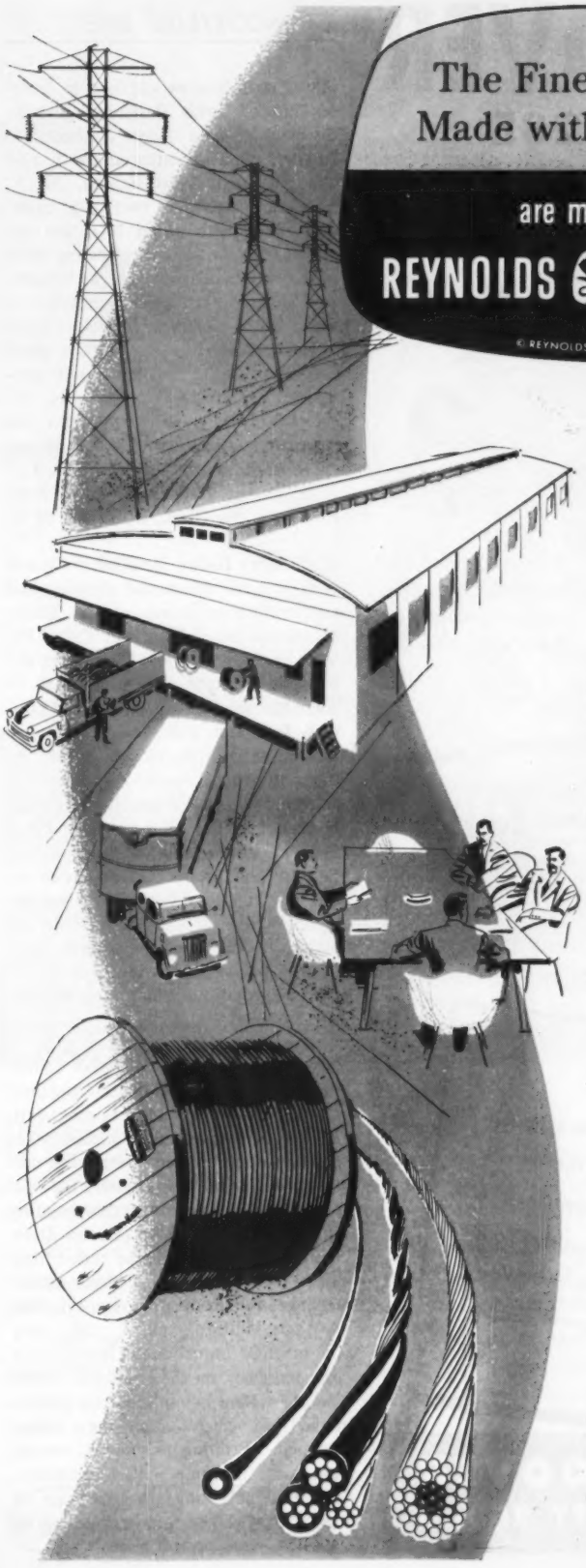
WEST VIRGINIA
Fairmont Supply Co., Fairmont
WISCONSIN
Ellison Electric Supply, Fond du Lac
Rahr's, Inc., Supply Division, Manitowoc



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For details, call your Reynolds Electrical Distributor or Reynolds Branch Office listed under "Aluminum" in your classified telephone directory. Or write *Reynolds Metals Company, P.O. Box 1800-EL, Louisville 1, Kentucky.*

See Reynolds new program "CIRCUS BOY", Sundays, NBC-TV.

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RUGGED LINE CONSTRUCTION BODY

Get's the job done

Faster, Better, Safer

Three man integral crew compartment cab is compact, comfortable, well-lighted and ventilated.

"Custom Features" like pull out material drawers with adjustable partitions save operators time.

EXTRA SAVINGS

Extra savings in operators time results from a double drum winch that mechanically operates the derrick which can be placed in the working position in a matter of seconds. Get all the facts about the York-Hoover Model YMW–128E Line Construction Body today! Write to Body Division, York-Hoover Corporation, York, Pa.

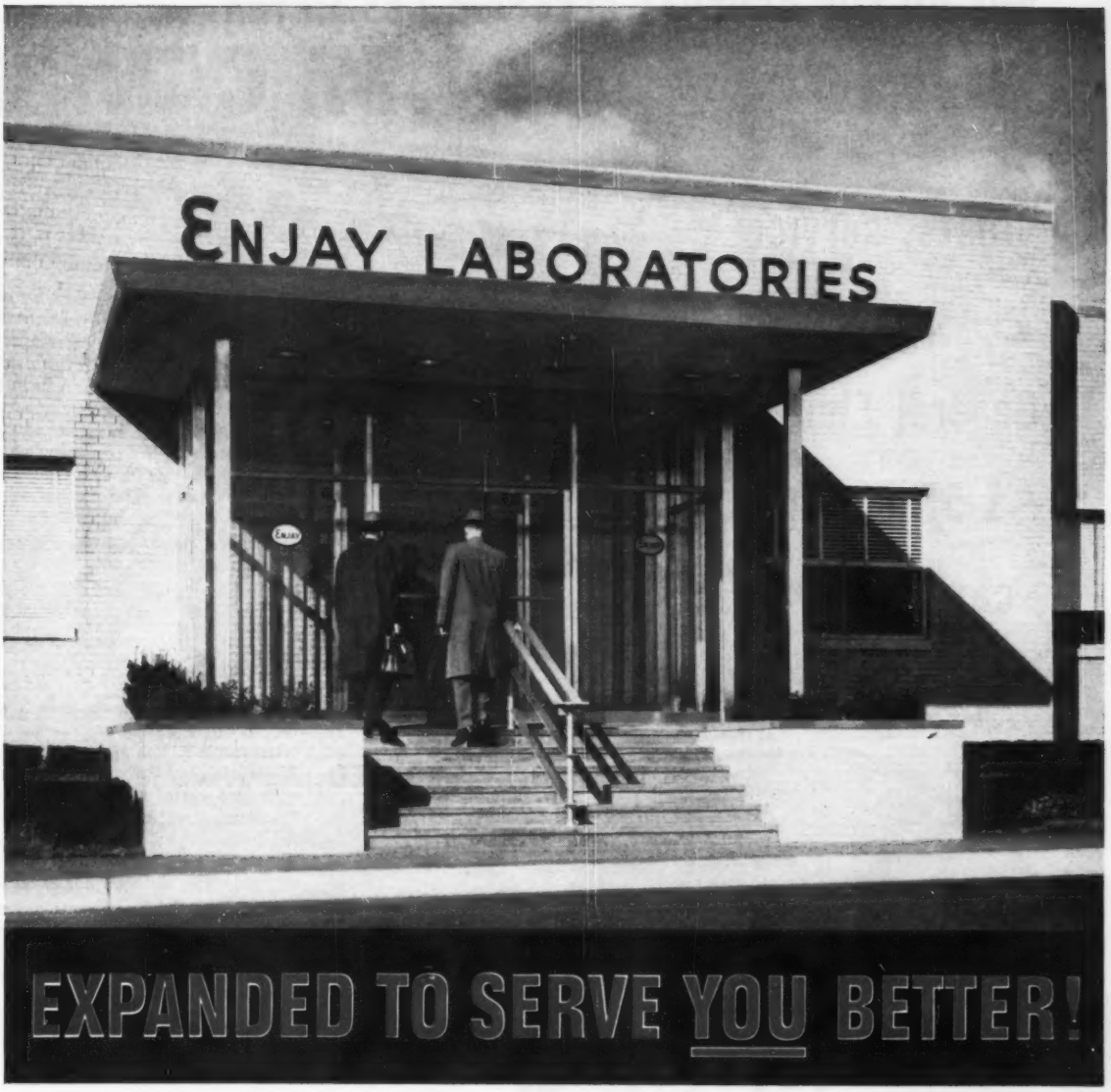
YORK-HOOVER
PUBLIC UTILITY BODIES

INDUSTRIAL BRIEFS

500-w strip heaters are used to transfer nitrous oxide (laughing gas) by distillation from large cylinders to smaller, clinical bottles at the Liquid Carbon Corp, West Seneca, N. Y. The lower halves of two large cylinders, filled with liquid NO_2, are enclosed with the six 240-v heating units in the well-insulated oven. The vaporized gas goes through a manifold to a watercooled condenser. In liquid form again, it flows directly into the small cylinders. The clean, accurately controlled electric heat evaporates the liquid more completely than the old steam system and is safe to use, despite the hazardous location. James Ackerman, Power Engineer, N. Y. State Electric & Gas Corp., Lancaster, N. Y.

A vibratory feeder, installed in the ash conveyor, has eliminated clogging and cut production losses at the Elmer Strackbein Block Plant, Mt. Cobb, Pa. With the new 440-v, 1-kw unit in the line, the operator no longer has to leave the mixing room, where all controls for sand, ash, and cement are located, to clear the clogged ashes. In the company's operation, ashes are delivered by truck, dumped into a large hopper, and fed to the mixing room by a conveyor and an elevator. Savings in time and production produced by the first vibratory feeder have led the company to install similar units in the sand and bulk cement conveyor lines. Charles Millar, Industrial Sales Representative, Pennsylvania Power & Light Co, Luzerne, Pa.

A variable speed electric drive system installed by the Midland Container Corp., Racine, Wis., has boosted production of corrugated cardboard boxes and almost eliminated waste. The unit drives and controls machinery for slotting, trimming and two-color printing shipping cartons. With the new drive, the production rate can be varied from 3,000 to 14,000 boxes per hour. Maintenance requirements are negligible. A pushbutton control can stop the machine immediately, leaving only one extra box on the conveyor. With the old system, about eighteen cartons were lost each time the system stopped. Printing is sharper, neater, and more accurate. The containers, delivered flat, range in size from 10 to 110 sq in. The line is often set up for new sizes several times daily.



EXPANDED TO SERVE YOU BETTER!

The Enjay Company proudly invites you to inspect the new polymer wing of the Enjay Laboratories, located in Linden, N. J. Continuing the tradition of pioneering in petrochemicals, Enjay has built this new laboratory addition for application research and development exclusively in the polymer division.

With the latest technical equipment and top scientific talent, this new laboratory enables the Enjay Company to give the best possible product application service, as well as furthering Enjay's own product research program.

High speed electronic data processing equipment helps the Enjay scientists solve your compounding problems in record time. In developing new products, or improving old ones, call on Enjay for top-notch assistance. Contact your Enjay representative for further information.

ENJAY BUTYL

Enjay Butyl is the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

ENJAY

Pioneer in Petrochemicals

ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y.

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ONLY ON THE GENERAL ELECTRIC I-55 METER:

$4.77 CAN BE

Tests, service prove General Electric I-55 meters can save you money

GREATER SUSTAINED ACCURACY

New test data on meter performance, compiled in G-E research laboratories, prove that General Electric's revolutionary "floating disc" meter provides high sustained accuracy which saves you money.

During accelerated life tests, identical loads were applied to the G-E I-55 meter and to meters with conventional bearing systems. The results are startling.

Here's the proof. Assume an average

GREATLY REDUCED TILT ERROR LOSSES

Any meter operating at even a slight tilt will give inaccurate readings that often result in loss of revenue. General Electric lab tests prove that I-55 meters with magnetic suspension "floating discs" are least affected by tilt—while the accuracy of meters with conventional ball bearing systems varies considerably with different angles of tilt.

Here's the proof. A conventional meter at one degree forward tilt, operating at a continuous average of 240 volts, 1.5 amperes, would lose .01728 kwhrs

NO PERIODIC BEARING REPLACEMENT

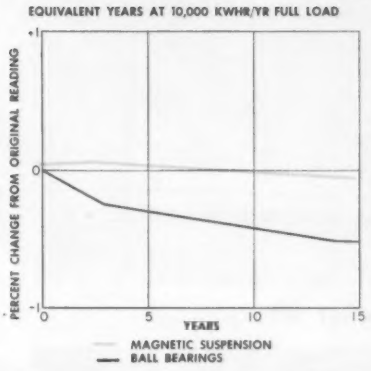
For complete details on how I-55 meters can save you money, call your nearby G-E Apparatus Sales Office. For information on the complete line of General Electric watthour meters, write Section 621-10, General Electric Co., Schenectady 5, N. Y.

TOTAL FIFTEEN-YEAR

GENERAL ELECTRIC

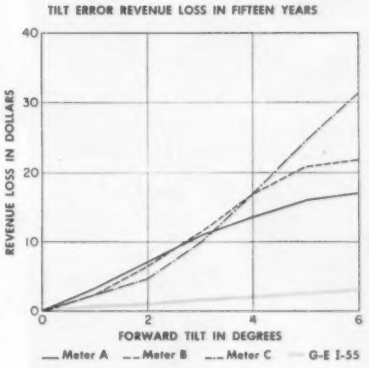
SAVED IN JUST 15 YEARS

kwhr usage per consumer (based on *Electrical World* forecasts) per year for fifteen years and the per cent loss on registration per year—the total loss in kwhrs would be 266.8 for a conventional meter. At two cents per kwhr, this means a gross loss of $5.34. By considering the "present worth" factor at 6 per cent interest for each year, the net loss on a conventional meter would be $3.14. The I-55 eliminates this loss and saves you the money.



$3.14

registration over the I-55 in 24 hours. In 15 years, the kwhr loss would be an amazing 94.40 kwhrs. Taking a reasonable figure of two cents per kwhr, the gross loss would be $1.89. By considering the "present worth" factor at 6 per cent interest for each of the fifteen years, the conservative saving realized by using a General Electric I-55 meter would be $1.29. And a glance at the chart on the right reveals much higher savings at tilt errors of 2 degrees to 6 degrees.



1.29

The trouble and expense of periodic bearing replacement is eliminated when you use General Electric I-55 meters with the "floating disc."

General Electric accelerated life tests prove that ball bearings in ordinary meters must be inspected and in many cases replaced after a comparatively short period of time. The G-E I-55 meter with magnetic suspension—and no bearings—showed no measurable wear even after the equivalent of more than 300 years of normal operation.

Bearing replacement is costly. Here's a typical example. Assuming replacement occurs after fifteen years' service, and taking into account an estimated average replacement cost and the "present worth" factor at 6 per cent interest, a conservative cost for bearing replacement on each conventional meter would be 34 cents. With no bearings to replace on the I-55 you save 34 cents on every meter.

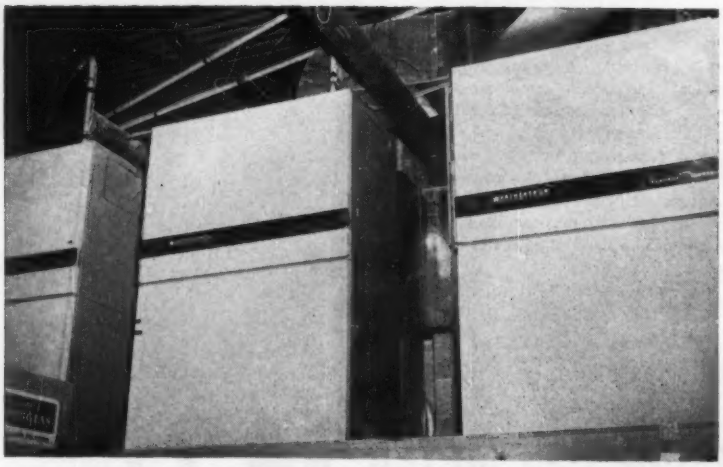
.34

AVERAGE SAVING USING I-55 METER $4.77

Lighting Teams Up with Heat Pump . . .

in this 75,000-sq ft supermarket where . . .

heat from 100-ft-c lighting supplements . . .



strip heaters in 20 packaged units

D. H. WHITE, Assistant to the Manager, Business Development Dept, Utah Power & Light Co, Salt Lake City, Utah

A newly opened Salt Lake City supermarket—claimed by its owner to be the largest in the world—will be provided with all its heat this winter by electricity. The cost is expected to be only $2,100—or less—in an area where 5,500 degree days are a normal occurence.

Largely responsible for this is the unique way the huge 75,000-sq ft structure teams up the heat from its lighting system with that turned out by its 20 five-ton heat pumps. In fact, heat output from the store's vast expanse of 100-plus ft-c lighting will account for about half of all the heat required. Thus summer cooling not winter heating was the principal design problem. It was cooling that ultimately determined the number of heat pumps needed.

Here's how this lighting-heat pump partnership works: As the temperature in the Salt Lake area may at times fall below the 14F balance point of the installation, it was necessary to provide some auxiliary resistance heating in each unit. These resistance heaters as they never would be needed during the hours of operation when the lighting was being used were supplied from the lighting feed circuits. This made it possible to reduce the size of the main panel and to eliminate a subpanel and a set of feeder circuits. An interlock prevents the heaters from being energized while the lighting is in use.

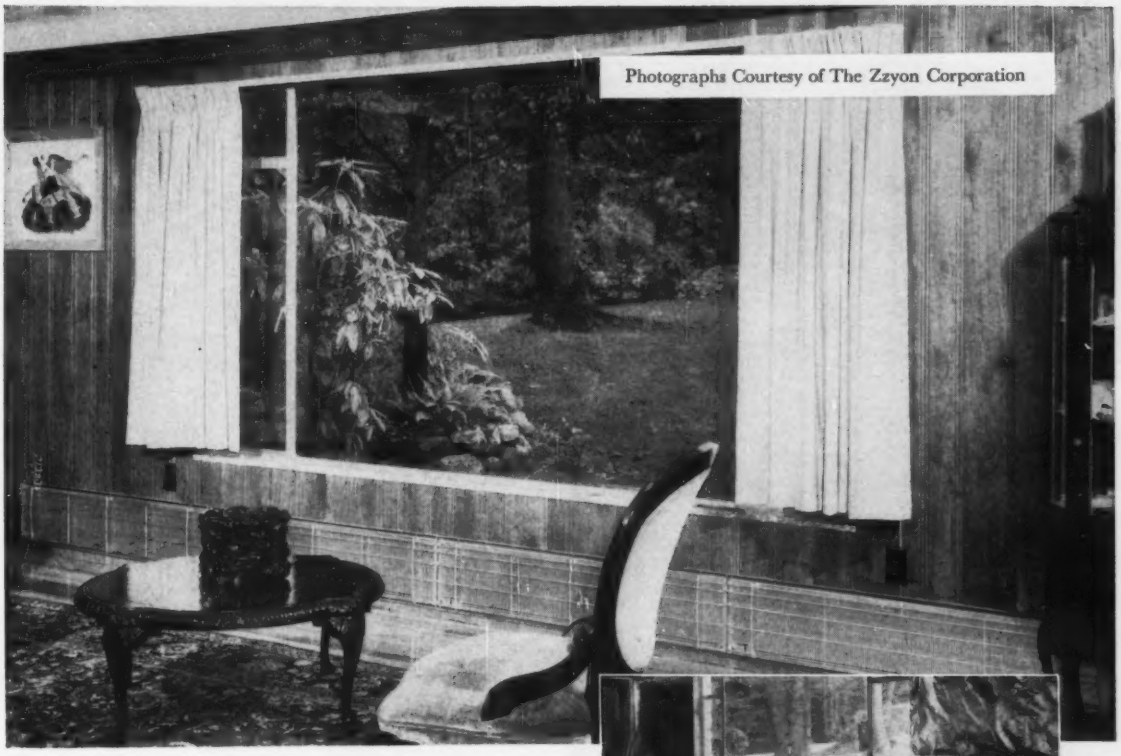
This arrangement also prevents the resistance heaters' electrical demand from pyramiding upon that of the regular store load and the heat pump motors. This saved both wiring and electrical energy costs.

Other selling points which caused the owner to choose heat pumps:

1. Cost analysis showed that first cost of the heat pump's year-round air conditioning was less than that of an evaporative cooling system coupled with unit-type gas-fired heaters.

2. The heat pump fit the owner's

(*Continued on page* 177)



Photographs Courtesy of The Zzyon Corporation

Proper insulation insures an economical, efficient heating system.

RADIANT GLASS HEAT

getting hotter every day

Demand for clean, safe and convenient heat explains the leaping growth of glass panel heating.

Ra-Grid* Heater Plates by Blue Ridge make possible one of the most adaptable heating systems . . . a big advantage in remodeling and expanding. Heating units can be installed in walls, baseboards or ceilings, or used as portable units. Regardless of where they're used, Ra-Grid Plates reach full operating temperatures in a shorter time than other heater plates. They maintain an even temperature throughout a room . . . free from drafts and cold spots.

You can recommend and use Ra-Grid Heater Plates with confidence. The glass is tempered for resistance to thermal shock and impact. For over 10 years, Blue Ridge has made Ra-Grid Heater Plates for manufacturers who fabricate them into complete heating units. Look for "Ra-Grid" imprinted near the edge of each glass panel.

This business is getting h-o-t! Write for further information and the names of radiant heat manufacturers who use Ra-Grid Heater Plates. *®

MADE BY **BLUE RIDGE GLASS CORP.**
KINGSPORT, TENNESSEE

BLUE RIDGE GLASS CORP.

Incentive for dealers . . .

Money-back guarantees . . .

Employee sales leads . . .

Three Proven Ways to Sell More Dryers

The clothes dryer is this year's hottest selling electric appliance. Its inherent convenience feature plus the boom in babies has made it a sales natural. So has some imaginative promotion. Here are three dryer sales approaches which any utility can use, regardless of size or budget:

1. The money-back guarantee. This was introduced with success last year by Cleveland Electric Illuminating Co (EW, Apr. 25, p 55).
2. Sales lead from employees.
3. Sensible incentives which dealer salesmen will work for.

All three have been put to work successfully in the past year—the guarantee by Kansas Gas & Electric Co, the employee plan by Kentucky Utilities Co, and the dealer incentive by Columbus & Southern Ohio Electric Co.

Under Kansas G&E's "Satisfaction Guaranteed" plan each participating dealer agreed to remove any 240-v electric dryer he sold if the customer was not completely satisfied. He agreed to refund all of the customer's payments on claims made within 30 days of the date of purchase. The dealer then billed KG&E for costs incurred, up to $30, on any unit returned.

KG&E did not pitch the "Satisfaction Guaranteed" theme in its own advertising. Instead, it stressed advantage, value and convenience. It was left to each dealer to promote "Satisfaction Guaranteed". The guarantee thus became his guarantee. The plan, says KG&E's Norman Jacobshagen, was offered as a sales-making and sales-closing plan which was essentially the dealer's.

"We felt the plan would sign many prospects who were on the verge of buying but just a little doubtful. By assuring the customer that it would cost him nothing if not completely satisfied, any risk was removed and the way paved for the close."

During the sixty-day campaign, only two electric dryers out of 745 sales were returned. In each case the dryer was being used with a conventional washer. The clothes contained too much moisture and drying times were longer than normal.

The campaign's 14% increase over sales made in the same period last year is more sizeable than might appear, reports Jacobshagen. Dealers were "fighting figures" of a 1955 campaign which had also been outstandingly successful. Potomac Electric Power Co is now trying a similar "guarantee" campaign.

Thanks in large part to its employees who ferreted out the prospects, Kentucky Utilities' clothes dryer sales on its system jumped 74% in 1955 over 1954.

Of the 1,367 company employees, 22.6% reported prospects that were passed on to dealers, says O. R. Williamson, director of new business for KU. Some 41.8%,

(*Continued on page* 178)

TWO NEW LINES OF WESTINGHOUSE TRANSFORMERS NOW GIVE YOU

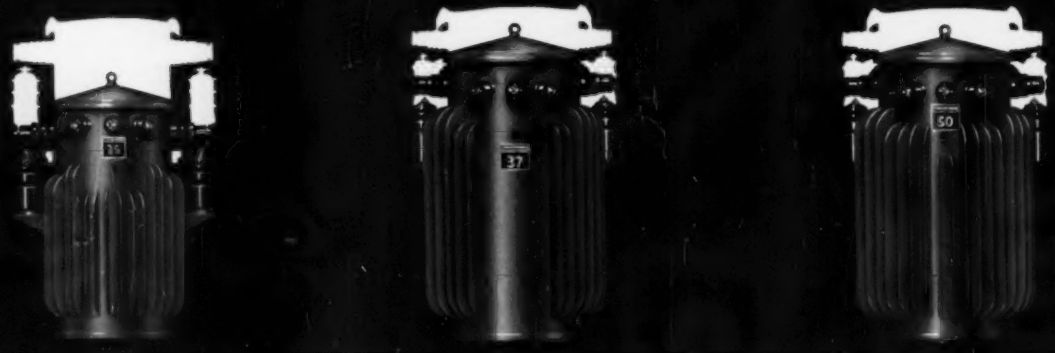
Unprecedented 20% increase in overload capacity . . . without sacrifice of service life

. . . proved by a revolutionary new concept of accelerated life testing which telescopes 30 years' service into 3. Here they are: (left) new, Type S conventional transformer with higher overload capability and optional, new thermal-duty indicator; (right) new CSP® transformer with higher breaker trip settings. These new tools for more effective load management will increase return on your distribution investment.

THE COMPLETE NEW LINES OF WESTINGHOUSE TRANSFORMERS . . .

Now up to 13″ shorter, 33% lighter without sacrifice in thermal capacity; mean substantial change-out savings in premium pole space

WALL MOUNTED TRANSFORMERS: 2400 and 4800 VOLTS



25 kva: Old—44″, 505 lbs.
New CSP—35″, 471 lbs.
New Type S—35″, 455 lbs.

37½ kva: Old—46″, 731 lbs.
New CSP—43″, 658 lbs.
New Type S—43″, 635 lbs.

50 kva: Old—46″, 846 lbs.
New CSP—43″, 755 lbs.
New Type S—43″, 740 lbs.

COVER MOUNTED TRANSFORMERS: 7200 and 7620 VOLTS

25 kva: Old—48″, 521 lbs.
New CSP—41″, 497 lbs.
New Type S—41″, 475 lbs.

37½ kva: Old—50″, 765 lbs.
New CSP—48″, 705 lbs.
New Type S—48″, 680 lbs.

50 kva: Old—50″, 831 lbs.
New CSP—48″, 760 lbs.
New Type S—48″, 730 lbs.

WATCH WESTINGHOUSE

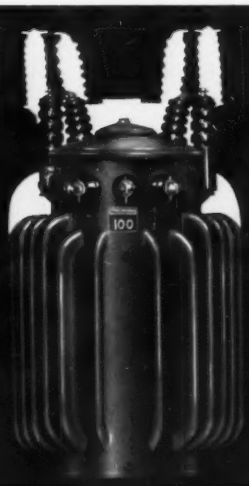
Here's a way to save on both installation time and equipment costs. Transformers of the next greater kva size can now be mounted in the same space without relocating secondaries. Make replacements, immediate or future, on the same pole—a real advantage where joint pole use is a practice. New installations require smaller poles. Specify Westinghouse, the only complete line of cover and wall-mounted bushing transformers with sweeping reductions in heights and weights.

75 kva: Old—52″, 1180 lbs.
New CSP—44″, 985 lbs.
New Type S—44″, 960 lbs.

100 kva: Old—52″, 1395 lbs.
New CSP—46″, 1160 lbs.
New Type S—46″, 1120 lbs.

167 kva: Old—58″, 2010 lbs.
New Type S—48″, 1490 lbs.

75 kva: Old—56″, 1210 lbs.
New CSP—50″, 1010 lbs.
New Type S—50″, 975 lbs.

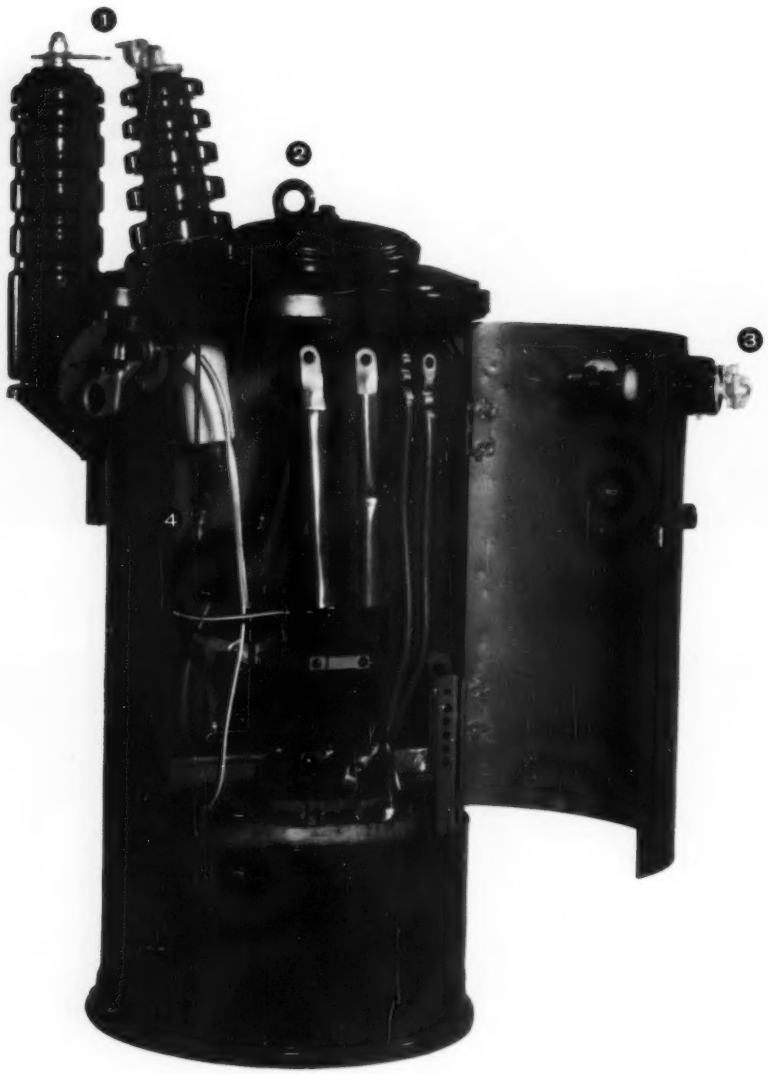


100 kva: Old—56″, 1420 lbs.
New CSP—54″, 1270 lbs.
New Type S—54″, 1230 lbs.

167 kva: Old—64″, 2240 lbs.
New Type S—51″, 1515 lbs.

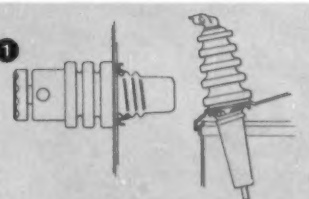
*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU**!*

Six new exclusive ideas simplify operating problems



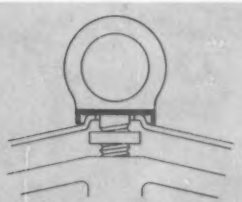
NEW THERMAL-DUTY INDICATOR . . . simplifies overload monitoring. Optional on Type S (conventional), it records total overload hours for the life of the transformer.

1



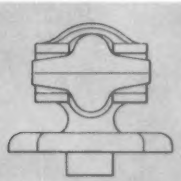
NEW THREADED HV BUSHINGS . . . simplify maintenance. Spring-grip nut, internally mounted, improves bushing seal.

2



CONVENIENT LIFTING EYEBOLT . . . (3-50 kva) eliminates slings, chains, cable; saves time in mounting transformers. Every unit pull-tested at twice its own weight.

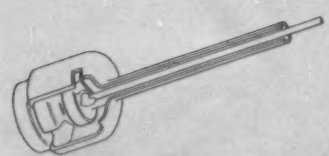
3



NEW LV TERMINALS . . . take both Al and Cu conductors. Larger terminal with captive bolt has contact area increased 25%, lowers resistance.

4

NEW PROTECTIVE LINK CHANGE-OUT . . . turns former major repair to simple, routine maintenance on all CSP® transformers, wall- or cover-mounted.



NEW PLASTIC BIRD GUARD . . . prevents line lockout caused by birds or squirrels. Optional equipment, it snaps easily over cover-mounted hv bushing.

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***

J-70780
Litho in U.S.A.

SAFE, FAST, EASY ON THE OPERATOR

Holan's Series 2200 Ladder elevates to 72°, rotates 360°, is available for ground-to-platform heights up to 32 feet.

Use coupon below for catalog

J.H. HOLAN CORPORATION
4100 WEST 150TH STREET
CLEVELAND 11 OHIO
OTHER PLANTS GRIFFIN, GA., PHOENIX, ARIZONA, BRANTFORD, ONTARIO

To: J. H. Holan Corporation
4100 West 150th Street
Cleveland 11, Ohio

Please send me the technical bulletin describing Holan's Series 2200 Mechanical Ladder.

Name_____ Title_____
Address_____
City_____ Zone_____ State_____

Lights and Heat Pump

(*Continued from page* 170)

desire for an ultra-modern structure.

3. The evaporative type cooler did not do an equivalent cooling job because of the high relative humidity it caused.

4. The heat pump needed no water which would have cost the owner almost $800 per season had he used an evaporative cooler.

5. Calculations showed that operating costs compared closely with those of a natural gas-fired system. In fact, as natural gas wasn't available at the time the building was planned, LP gas, which otherwise would have been used, would have cost almost twice as much.

6. The "earned depreciation" financing plan offered by the distributor allowed the owner to buy the installation and have less than 10% of the cost on his books as capital investment during the 10-year life of the purchase agreement.

2-Way Sales Effort

Actual selling of the job was a cooperative effort between Utah Power & Light personnel and the distributor. UP&L's commercial consultant spotted the job and worked closely with the owner throughout the planning and construction stages. The division sales manager sold the architect, convincing him of the heat pump's cleanliness, space saving features, and competitive initial and operating costs. In fact, it was found the complete installation cost less than the store's 35 cash registers.

Below 1¢ per Kwhr

The UP&L division commercial supervisor and the equipment distributor handled the cost estimates. Using two different calculations, they came up with comparable monthly kwhr use and kw demand. UP&L's regular commercial rate schedule was applied to both the total and the heat pump usage. It was found the average cost for heat pump use was slightly under 1¢ per kwhr. Allowing for an unusually cold winter, the owner was quoted a figure of $1,800 to $2,100 per season for heating service.

The building itself is of insulated metal panel walls, concrete slab floor with terazzo surface, sawtooth type roof construction, and very little glass window area. The heat pump units

CHANGE ELEVATION WITH MAN ON PLATFORM

New Holan Series 2500 Ladder gives you some of the benefits of a fully-hydraulic ladder at a price close to that of a mechanical ladder. Angle of elevation can be changed with a man on the platform.

For your copy of the 2500 catalog, use the coupon below.

J.H. HOLAN CORPORATION
4100 WEST 150TH STREET
CLEVELAND 11 OHIO
OTHER PLANTS GRIFFIN, GA., PHOENIX, ARIZONA, BRANTFORD, ONTARIO

To: J. H. Holan Corporation
4100 West 150th Street
Cleveland 11, Ohio

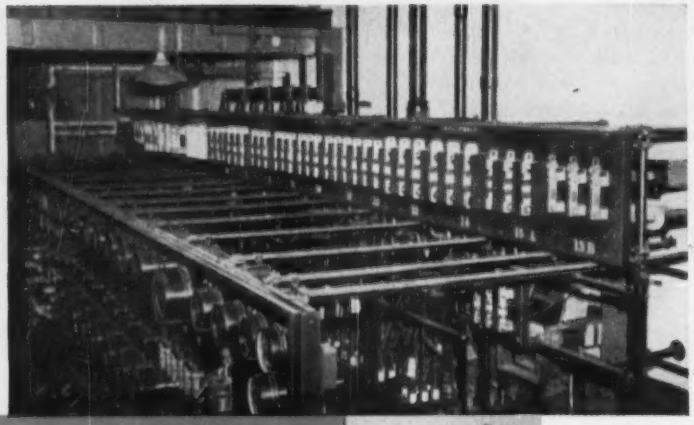
Please send me the catalog that tells all about Holan's Series 2500 Ladder.

Name_____ Title_____
Address_____
City_____ Zone_____ State_____

Anticipate* Destruction

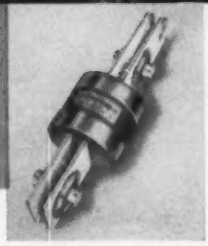
Amp-trap PREVENTS DEVELOPMENT OF HEAVY SHORT CIRCUIT CURRENTS

* To preclude or prevent by prior action — " Webster



SHAWMUT Amp-trap*

"T. M. REG. U. S. PAT. OFFICE"



Amp-trap installation at Bird & Son, E. Walpole, Mass., raised the interrupting capacity of the system from 20,000 amperes to 100,000 amperes R.M.S. at 600 Volts, 60 Cycles.

NEW, LOW-COST SHORT CIRCUIT PROTECTION

Amp-trap, with its 100,000 RMS Interrupting Capacity, opens the circuit so fast that it *precludes* the development of the peak available short circuit current. Consequently, it *prevents* both magnetic and thermal destruction. Even phase-to-ground faults are cleared so quickly that multi-conductor faults are usually avoided.

CERTIFIED AND APPROVED

Amp-trap is listed by Underwriters Laboratories. Interrupting tests up to 202,000 amps at 500v 60 cycles have been witnessed and certified by Electrical Testing Laboratories, Inc. Amp-trap is favored by many insurance companies.

FOR SYSTEMS OLD OR NEW

Amp-trap is supplied in all standard ratings up to 4000 amperes for application on any circuit up to 600 volts AC or DC. It can be used on either old or new switchgear with a minimum of structural rearrangement. "Outage" time for installation is negligible. There is no better way to insure your investment in switchgear, buss-ducts, motor starters, circuit breakers and current transformers. Every service entrance on a network system needs Amp-trap protection. The list of Amp-trap users reads like the Blue Book of American industry. Investigate now.

"You Can Get Amp-traps"

WRITE FOR FREE AMP-TRAP BULLETIN TODAY

REGISTERED UNITED STATES PATENT OFFICE Est. 1902

AMP-TRAPS — *Awake At The Switch*

THE CHASE-SHAWMUT CO.

374 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS

Amp-trap Trion td C-O-T Trionet and O-T types FUSE WIRE

are installed in banks of five each at four different locatons. Each installation controls the temperature in the zone of the store in which it is located. This arrangement allows for variations in temperatures from one department to another according to needs. Other facts:

- The building has a total 1,573,000 Btu's per hr heat loss in winter and a 185,000 Btu heat gain in summer.
- "Flywheel" effect of heat stored in the huge quantity of merchandise and in the building construction material is expected to be enough to prevent the auxiliary resistance heaters from operating except in exceptionally cold weather.
- A 500-kw total electrical requirement is anticipated. Load is supplied at 120/208 v, 4 wire, 3 phase, under UP&L's standard rate schedule. Building includes 21 miles of wiring.
- Total refrigerated food storage space is equivalent to 2,000 residential refrigerators. There are more than 630 ft of refrigerated display cases.
- Building cost $1 million plus $400,000 for fixtures and equipment.

This installation plus one of 12 similar units at Utah Power's new Ogden division building (EW, July 30, p 48) was instrumental in securing an order for four heat pumps from Safeway Stores, Inc. These will go into one of the chain's new stores now under construction in Salt Lake City

3 Ways to Sell Dryers

(*Continued from page* 172)

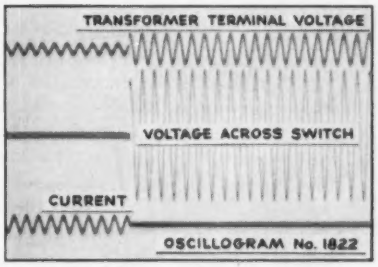
or better than four out of every ten prospects given to dealers were sold. At the end of the drive the company had increased its dryer saturation by more than 1%.

Heaviest sales were concentrated in two campaigns—one in January-February-March, the other in October-November-December. Both tied in with Edison Electric Institute's coordinated campaigns to take full advantage of national publicity appearing in women's service and shelter magazines.

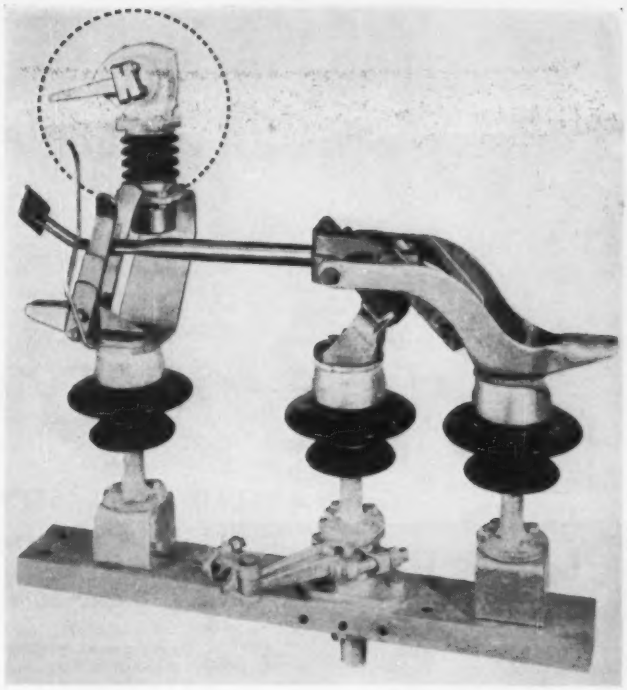
A distributor meeting kicked off the drives. This was followed up by a series of local dealer meetings. Follow-up contacts were made on individual dealers by 35 home service advisors, the division customer service manager, and district and local man-

(*Continued on page* 180)

Powerupter installed on Delta-Star MK-40 Switch—is actuated by switch blade movement, providing instant circuit interruption without external arc or flame.



Typical oscillogram made during interrupting test of Delta-Star's Powerupter at 15 kv.



NOW

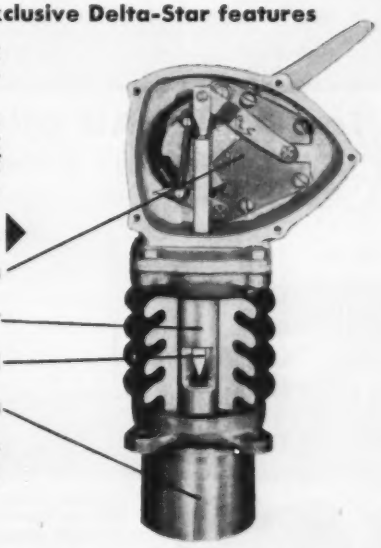
DELTA-STAR'S New *Powerupter* Switch!

Voltage ratings from 7.5 kv through 34.5 kv—built with exclusive Delta-Star features

This new Delta-Star Powerupter combines a new interrupting device with the most modern disconnecting switches—for interrupting load, magnetizing and charging currents.

The Powerupter features heavy duty construction throughout. Its exclusive automatic trip mechanism provides instant breaking and making speeds independent of switch operation. No feature of Delta-Star switches is sacrificed—every characteristic is retained.

Cutaway view shows *Powerupter* operating advantages



Powerful, high speed mechanism controls speed of Powerupter's operation independently of main switch operating time.

Arcing chamber lined with gas-evolving material. Chamber contains stationary contact and moving contact.

Follower of gas-evolving material confines arc—insuring rapid arc extinction at low current values.

Exhaust chamber provided with muffler—confines and cools exhaust gases released from interrupting chamber.

Ratings: Voltages, 7.5 kv through 34.5 kv; interrupting capacity 600 amp. Continuous current ratings, 400, 600, 1200, 2000 amps.

For all the facts, write Delta-Star or ask your nearby representative. Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton St., Chicago 12, Ill. District offices in principal cities.

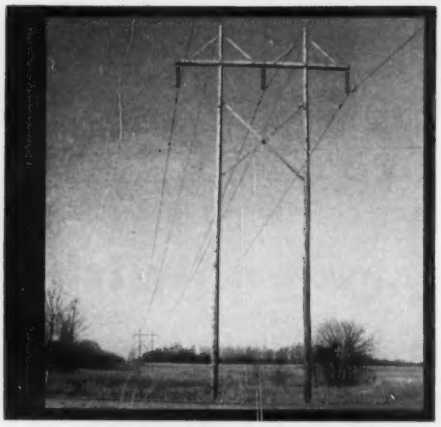
HKP

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.

Other divisions of H. K. Porter Company, Inc., are: Alloy Metal Wire, Connors Steel, Esaco, Henry Disston, Laclede-Christy, Leschen Wire Rope, McLain Fire Brick, Quaker Pioneer Rubber, Quaker Rubber, Riverside Metal, Vulcan Crucible Steel, W. S. Fittings.

GALVANIZED STEEL STRAND

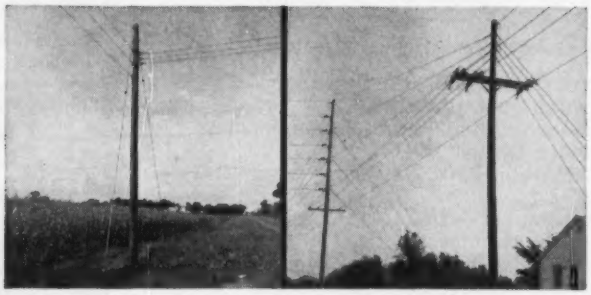


YOUR ASSURANCE OF HIGH QUALITY, LONG LIFE AND LOW COST

Close laboratory control over each step in manufacture has established Crapo Galvanized Steel Strand as a product of highest quality and dependability. You benefit through longer service life and lower ultimate costs.

Heavy, uniform, tightly-bonded coatings of commercially pure zinc, applied by the famous Crapo methods, withstand the punishment of construction, provide maximum resistance to corrosion and contribute to over-all economies.

For OVERHEAD GROUND WIRE . . .
CRAPO Weldless Galvanized Steel Strand



The most practical and economical strand for shielding transmission lines against lightning. Maximum strength and high fatigue endurance, inherent in Crapo Weldless Strand, provide that extra safety factor so important in overhead ground or static wire.

For GUYS and MESSENGER . . .
Crapo Galvanized Steel Strand. Made to highest standard specifications . . . a size and breaking strength to meet all practical needs.

Contact your jobber or write for descriptive folder.

INDIANA STEEL & WIRE CO., INC.
Muncie, Indiana

3 Proven Ways to Sell

(*Continued from page* 178)

agers in their respective areas.

These calls had a two-fold purpose: First, to deliver EEI display kits; second, to offer company help in conducting group demonstrations. These demonstrations were held either in the dealers' stores, company auditoriums, or prospects' homes.

Dealers also were encouraged to display dryers in company offices during the campaigns. Each dealer was permitted to display whatever brand he desired, to identify his merchandise, and to post a sales representative on the company's display floor.

Cash for Employees

With the regular sales channels set up, K.U. then was ready to play its ace—its employees. Meetings were held encouraging employees to talk dryer benefits and to report names of customers whom they believed to be prospects. Campaign plan books were distributed to each office outlining the details for handling prospects and the basis upon which commissions would be paid for sales made.

Prizes were awarded to K.U. district managers getting the best results. Winners were determined on basis of dealer sales and employee participation. Cash also was awarded for outstanding employee results. To maintain a record of prospects turned in and to stimulate competition among employees, wall charts were furnished each office. Total number of prospects turned in each week and the sales to these customers as reported by dealers were recorded on the charts. Bulletins were issued each week showing the standing of individual offices as well as overall division results.

Ball Games to Dealers

Columbus & Southern, meanwhile, tried another tack. Last fall dealer salesmen were given expense-paid trips to the Ohio State-Michigan football game at Ann Arbor if they sold 10 or more dryers during a six-week campaign. Those who sold 16 or more could take their wives too.

How well did it work? Columbus & Southern picked up the tab for 204 winners, saw 2,600 dryers go onto its lines. The company has 217,000 residential meters. Ball game incentives are now a regular part of its program.

how BLH turbines help to power the boom in our great Northwest

In the booming Pacific Northwest, rivers work harder for man than in any other comparable area in the world. BLH turbines, at 27 huge dams, are converting water power into electric power—key to the area's remarkable growth. These BLH hydraulic turbines, with over 3½ million total rated horsepower, produce more than 2½ million kilowatts every hour they run.

In addition to building all four basic types of turbines—Impulse, Kaplan, Francis and Propeller—BLH manufactures surge suppressors, valves, pumps, governors and other accessory equipment. On your next project, why not call BLH in early? For a copy of our illustrated catalog 1000, write BLH Corporation, Philadelphia 42, Pennsylvania, or Dept. 5607, Pelton Division (BLH), 2929 Nineteenth Street, San Francisco, California.

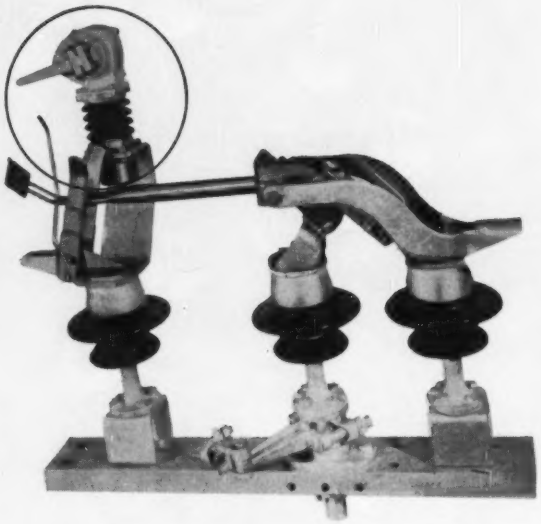
BALDWIN BLH LIMA-HAMILTON

EDDYSTONE DIVISION
BALDWIN-LIMA-HAMILTON

DIVISIONS: Austin-Western • Eddystone • Electronics & Instrumentation • Lima • Hamilton • Loewy-Hydropress • Pelton • Madsen • Standard Steel Works

NEW EQUIPMENT

Interrupter Switch

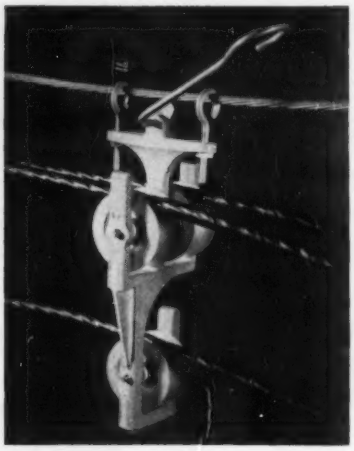


An interesting line of interrupter switches, designated as "MKR-40 Powerupters," have been designed to permit safe interruption of load, magnetizing, and charging currents up to 600 amp, without danger of external arcing or flame.

The switches combine the features of standard group-operated vertical break switches with those of a recently designed interrupter (encircled). Double acting mechanism is used to assure instant arc extinction, either in opening or closing circuit. Laboratory and field tests indicate that at rated values interruption occurs in less than one cycle. The Powerupter is available in voltage ratings from 7.2 to 34.4 kv, in continuous current ratings of 400, 600, 1,200 and 2,000 amp.

The interrupter itself may be used in connection with any Delta-Star disconnect switch.

H. K. Porter Co, Inc—Delta Star Division
2437 Fulton Street, Chicago, Ill.

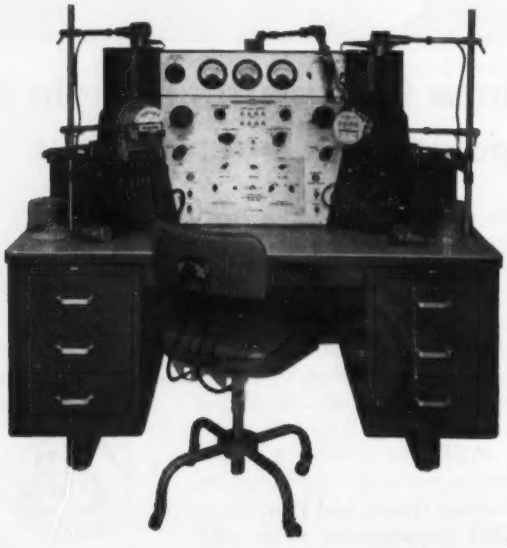


Tri-Pulley Stringing Block

This tri-pulley stringing block is said to make the installation of aerial cable, such as the Hendrix type, easy, while saving time and money. Only one climb is needed to install clamps and to remove the blocks. Blocks are positioned on a messenger at 30-ft intervals with the three conductors in place as the conductors are being pulled in. All three conductors are reportedly easily and accurately sagged at one time while resting on the pulleys.

Hendrix Wire & Cable Corp, 19 Watson Street, Boston 18, Mass.

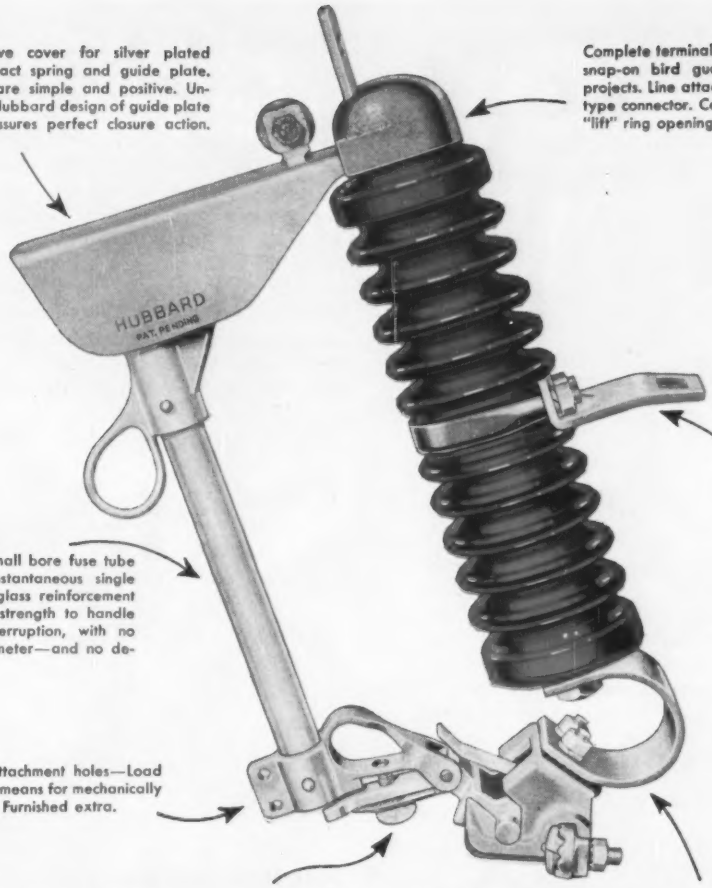
FRSDK Test Table



According to the manufacturer, this type FRSDK test table permits testing simultaneously one watthour meter at light load and adjust another for full load or 50% pf by one operator.

The table has a 100-amp capacity and is designed for high load. While the light load is being tested by the photoelectric method on one meter, the other meter is being adjusted for full load under a strobo beam. A transfer switch can then be used to shift the controls to the opposite position. Thereupon, the meter that has received the light load test, is checked stroboscopically for full load—and vice versa.

States Co, 19 New Park Ave., Hartford, Conn.


Sleet Hood, protective cover for silver plated phosphor bronze contact spring and guide plate. Closure and contact are simple and positive. Unaffected by weather. Hubbard design of guide plate and contact spring assures perfect closure action.
Complete terminal protection is provided by flexible snap-on bird guard through which a "lift" ring projects. Line attachment is by means of transformer type connector. Conductor may be snubbed through "lift" ring opening if desired.
HUBBARD
PAT. PENDING
New style, extra strong, insulated hanger. Coating provides bird and animal protection.
Specially designed small bore fuse tube for high pressure instantaneous single vent expulsion. Fibreglass reinforcement provides mechanical strength to handle maximum current interruption, with no increase in bore diameter—and no destructive results.
Load break fitting attachment holes—Load break fittings provide means for mechanically disrupting connection. Furnished extra.
Cam locking device which permits unobstructed removal of fuse holder when in the open position, in addition to locking holder against accidental removal the instant closure is begun. Spring actuated leverage arrangement puts tension on fuse link to aid in quick opening.
Locked recoil absorber bracket is provided to cushion recoil of discharge action. This prevents damage to the porcelain and mechanical assembly under stress of maximum current interruptions.

New Hubbard Distribution Fuse Cutout!

Now from Hubbard a new heavy-duty fuse cutout that opens a new era in the protection of equipment on your distribution lines. Incorporating new electrical and mechanical designs, the new Hubbard Cutout offers tremendous operational flexibility with its ability to clear faults over the entire operating range from minimum to maximum available fault current. No longer will it be necessary to continually check available fault current values at many different points as your system is expanded. What's more, the need for shifting cutouts to handle changing fault current values will be drastically reduced.

Heart of the new design is the small bore fibreglass reinforced, single vented fuse tube. By using a minimum inner diameter fuse tube and reinforcing it with fibreglass for maximum mechanical strength, Hubbard engineers were able to provide the positive expulsion action necessary for safe, sure, instantaneous arc interruption.

To support this greatly increased bursting action, entirely new high strength mechanical components were provided. There are no unnecessary or complicated parts in this new rugged simple design. Gas expulsion and fuse blowing are substantially completed before any parting of current carrying contacts. The entire current carrying circuit is composed of silver plated contacts of the pressure type. All springs are designed to act well below their elastic limits for maximum pressure maintenance throughout the life of the cutout. Positive closing is assured through the cam arrangement of the hinge mechanism which causes the fuse tube hinge to tighten as the fuse approaches the latched position.

Equipped with sleet, bird proofing and dead-end eye to meet local service conditions. Mechanical load break attachment can be specified as needed. Your Hubbard distributor will be glad to supply you with production samples. Call today, or write for a copy of Bulletin 756.

HUBBARD AND COMPANY

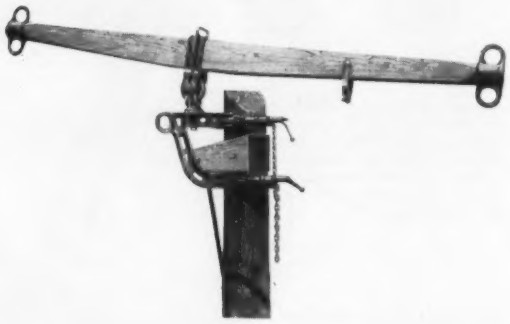
Pittsburgh 1, Pa.
Chicago 50, Ill.
Oakland 8, Calif.
Dallas (Plano), Texas

Universal Test Bench

This universal test bench provides complete facilities for testing and quality control of electrical components, according to the manufacturer. It incorporates instruments for measuring speed, time interval, voltage, current, resistance, power, torque, etc. An individual plug-in fixture is designed for each component to be tested; when component design is changed, new test requirements are accommodated by simply changing the fixture. It is not necessary to re-work the bench, thus providing, flexibility suitable for production with frequent design changes as in the aircraft industry.

Performance Measurements Co
15301 W. McNichols Road, Detroit 35, Mich.

Multi-Duty Gin



This multi-duty gin reportedly can be used for pole-top and down-pole mounting, or for lifting single transformers. On top the pole, its rocker-action swinging beam help to position the load. It can be mounted down pole without changing the bracket, or the bracket can be used alone for hanging transformers. It will straddle a cross-arm. Two models are available, rated at 1,500 and 2,500 lb.

A. B. Chance Co, Centralia, Mo.

Aluminum or Steel Clamps

A series of "BTC" aluminum or steel drop-forged straight line clamps, with or without socket adapters, are available for use on all distribution, light transmission and substation conductors. They come with bore size ranges from 0.30 to 1.25 in. The corona-free clamps reportedly have a rated ultimate strength of 15,000 lb for steel and 12,000 lb for aluminum. The loop is large enough for a come-along hook or shackle.

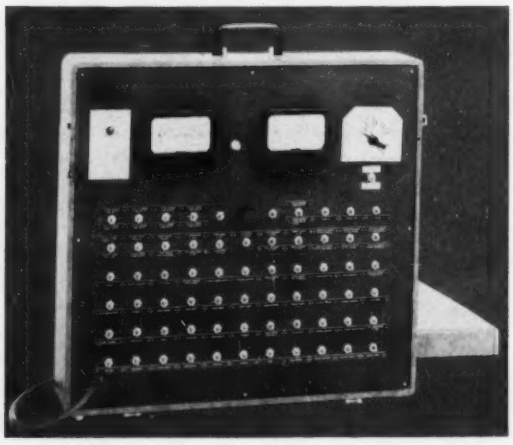
Brewer-Titchener Corp, Cortland, N. Y.

Adequate Wiring Analyzer

This device, called an "Adequate Wiring Analyzer," is said to permit the non-technical layman to calculate such circuit characteristics as voltage drop and service entrance size. It is designed for office use, group meetings and demonstrations in which loads for the household or farm are considered. The load requirements of various appliances and machinery are set on the board (It will accommodate 67 specific types.), a switch is flipped, the load is totalled, and the voltage drop readings at either 120 or 240 volts for given wire sizes and lengths may be read. Range is from 150 to 11,150 watts. Size 25 x 23 x 8 in. Weight 45 lb.

Rehm Mfg Co,
5300 Benton Ave, Minneapolis 10, Minn.

(*More New Equipment on page* 188)



NO DOUBT ABOUT IT . . SO PITTSBURGH STANDARD CONDUIT THREADS ARE HOT-DIP GALVANIZED

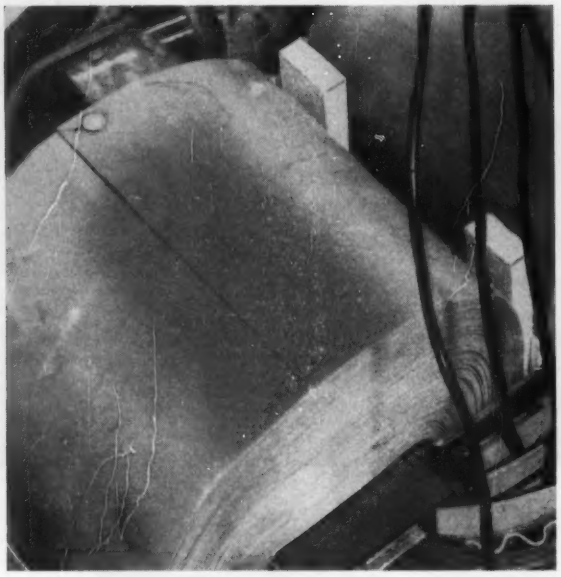
Cost for rigid steel conduit must be measured by both purchase price *and* labor cost for putting the conduit in place. If workmen's time must be spent in chasing rust from threads, then you pay more—make less on the job. That's the reason Pittsburgh Standard gives you hot-dip galvanized threads on hot-dip galvanized conduit *on every size through 6-inches.* And because Pittsburgh Standard owns the world's most modern conduit mill, these hot-dip galvanized threads come to you *at absolutely no extra cost.* This is a major advance—company after company is rewriting specifications to call for Pittsburgh Standard Conduit. Available from your Pittsburgh Standard wholesaler, or write *Pittsburgh Standard Conduit Co., 61 Bridge St., Pittsburgh 23, Pa.*

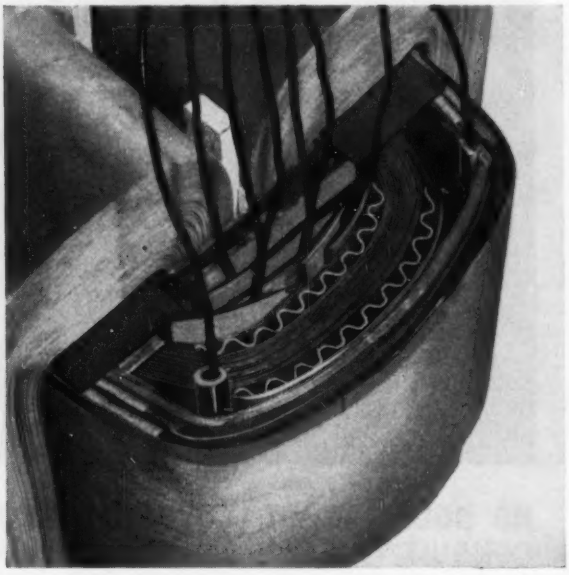
PLANTS AT MORRISVILLE & ETNA, PA.

RIGID STEEL CONDUIT • ELECTRICAL METALLIC TUBING • ELBOWS • COUPLINGS • FITTINGS

4 KUHLMAN TRANSFORMER FEATURES YOUR DISTRIBUTION SYSTEM'S

Kuhlman increases distribution system efficency by continuously improving basic transformer design. While new features have been added as they have been proved . . . major benefits spring from Kuhlman's concentration on engineering refinements in the basic components of transformer design . . . the core, coil, construction and insulation. Your study of the features illustrated below will show what we mean. Why not check your local Kuhlman representative on *all the features* that make Kuhlman your No. 1 transformer buy.





***FEATURE*—BENT IRON CORE:**
Lapped construction eliminates air gaps, offers low flux density in the lapped areas.

RESULT:
Lower exciting current; less load on the distribution system; reduced operational costs.

***FEATURE*—BALANCED COIL:**
Compact windings of low temperature rise are balanced with ample cooling ducts for oil circulating and rapid heat transfer.

RESULT:
Greater short-time overloading capacity; longer, more reliable transformer life.

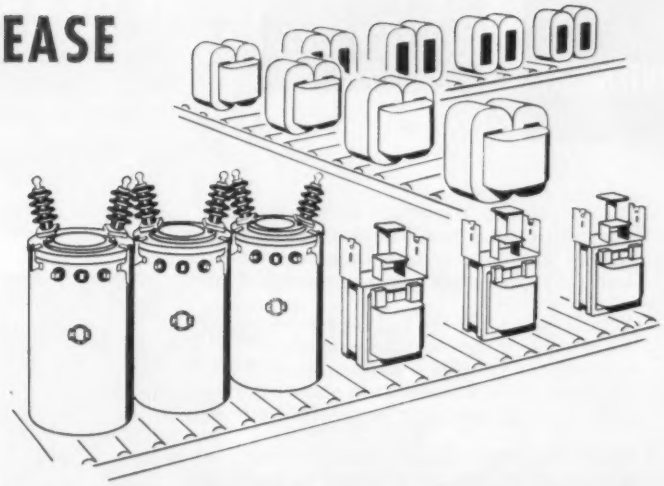
HOUSEPOWER HELPS YOU LIVE BETTER ELECTRICALLY
LIVE BETTER ELECTRICALLY

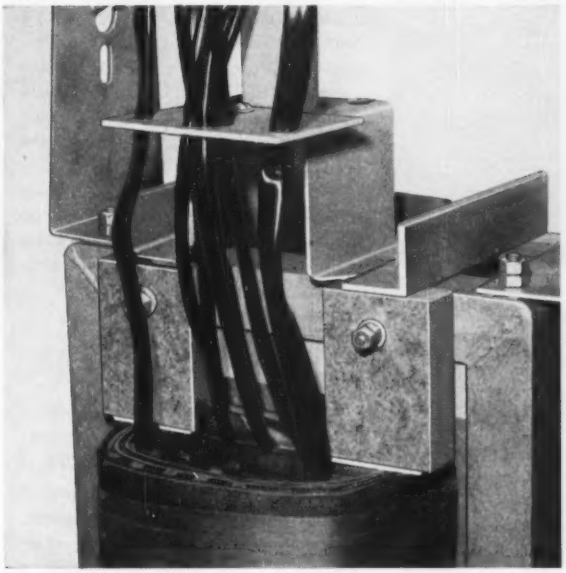
KUHLMAN

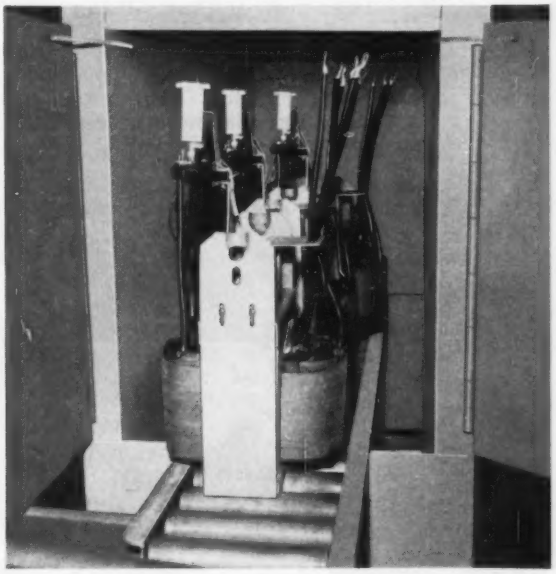
BAY CITY, MICHIGAN • CRYSTAL SPRINGS,

THAT CAN INCREASE EFFICIENCY...

- ★ LOW EXCITING CURRENT
- ★ CAPACITY TO SPARE
- ★ RIGID CONSTRUCTION
- ★ LOW POWER FACTOR







***FEATURE*— RIGID CONSTRUCTION:**

Core and coil assembly held firmly in place by core clamp; additional blocking for coil support; leads held rigid by lead guides.

RESULT:

Greater protection against short-circuit stresses and damage from handling and shipping. Longer trouble-free operating life.

***FEATURE*— POWER FACTOR CONTROL:**

Moisture eliminated by controlled processing; coils pre-dried before varnishing . . . coils varnished and baked . . . core and coil assembly dried on the line (as shown above) . . . unit is tanked and put under oil while still above room temperature . . . vacuum removal of all entrapped air.

RESULT:

Low power factor indicating high insulation strength and assuring long service life.

ELECTRIC COMPANY

MISSISSIPPI • SALINAS, CALIFORNIA

5/2

MR.
LINE
SUPERINTENDENT:

WHAT DO
YOU KNOW
ABOUT
RT&E?

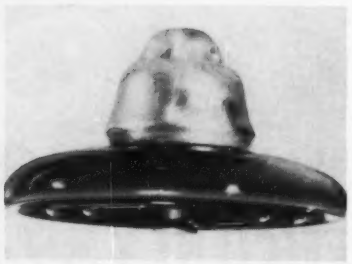
As one of the important men who keep power flowing to the nation's homes and industries, you should know something about one of America's leading suppliers of power equipment.

While we are not the largest transformer builder, we are one of the most dependable. We keep your concern for your men and equipment in mind at all times. A little more care on our part will save time for your men and money for your company.

We have several exclusive features that were either suggested by you, or designed to make the work of your men easier and faster. Our externally operated tap changer is standard equipment; our dual voltage transformer is operated from outside the tank. Maintenance and service calls are minimized by our radio noise-proof construction, high overload capacity and lightning surge strength. Our units are guaranteed for five full years.

Next time your men go out to install an RT&E Transformer, you can be sure their job will be speedy, simple, and safe.

RT&E CORPORATION
WAUKESHA, WISCONSIN
Equipment to help provide power for America



Suspension Insulator

This extra-high strength suspension insulator is the second GE insulator design based on a new, strong porcelain body. Known as the "XHS" suspension insulator, it is rated at 25,000 lb, mechanical and electrical strength, though its dimensions are said to be comparable to the ASA standard 15,000-lb insulator. Advantages of the XHS over the standard 25,000-lb ball-and-socket insulator (ASA standard 52-5) reportedly include doubled impact strength, a 20% reduction in weight, and a choice of three spacing dimensions. Its rated impact strength of 120 lb is believed to be the highest impact rating of any suspension insulator ever offered the utility industry.

The XHS is intended for use on suspension and dead-end towers, on bundled conductor applications, extra high voltage installations or in contaminated atmospheres.

General Electric Co
P. O. Box 57, Baltimore, Md.

Phenolic Laminate

A paper-base phenolic laminate with reportedly excellent electrical properties is said to also have the benefits of cold punching and shearing characteristics. Its grade designation is P-25. Because it punches clean and sharp at room temperature, the laminate eliminates hot punching shrinkage allowances and heating equipment, according to the manufacturer. P-25 has high insulation resistance and low dielectric loss. It is available in plain sheet form or copper clad. Its tensile strength lengthwise is 12,400 psi; compressive strength flatwise 25,000 psi; flexural strength (⅛ in. thick) 12,000 psi; shear strength 11,000 psi; specific gravity is 1.30; coefficient of thermal expansion is 2 x 10^{-5}; water absorption in 24 hours is 1%; dielectric strength,

(*Continued on page* 192)

The Case of WASTED HORSEPOWER

or

"Over-motoring" is outmoded by Dow Corning Silicones

SCENE: Pump room, Anyplant, U. S. A.

CHARACTERS: TINY H.—a 5 hp Class H motor insulated with Dow Corning Silicones.
BLUSTER A. — a 7½ hp Class A motor.

TINY H: You're goofing-off again! Why don't you try moving a bigger load now and then?

BLUSTER A: Nuts to you, Tiny. I'm working hard enough keeping this little pump going.

TINY H: But you're strong enough to drive a bigger pump . . . or are you?

BLUSTER A: That's enough. I should worry—the engineers who put me here figured I might have to carry a 6 hp load—er—once in a while, at least.

TINY H: Sooo what! I'm rated to match our average load. My silicone insulated innards give me extra muscles to carry any overloads. Why—I could pump a 7 hp load and still be here when you're dead and gone.

BLUSTER A: Shut up, Tiny! Somebody might hear you.

TINY H: Okay, fat stuff, but you can't hide the facts forever. Mark my nameplate—one of these days the boss will figure out how much money you're wasting and you'll have had it.

You can match the load . . .
let Silicones carry the overload

Lazy motors cost money! Why continue to pay a fat premium for motors that make kid's play of their average work load? Today, you can save money by using silicone insulated motors rated to match your average load. Their built-in service factor of 25 to 50% will handle most intermittent overloads or loads that can't be matched in standard frame sizes.

Remember, over-motoring is outmoded

Get sources for silicone insulated equipment—mail coupon today

Dow Corning Corporation, Dept. 4411, Midland, Mich.

Please send me sources of supply for new Silicone (Class H) ☐ Motors ☐ Transformers

NAME _____ TITLE _____

COMPANY _____

STREET _____

CITY _____ ZONE ____ STATE _____

DOW CORNING SILICONES

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

ATLANTA • BOSTON • CHICAGO • CLEVELAND • DALLAS
DETROIT • LOS ANGELES • NEW YORK • WASHINGTON, D. C.
(Silver Spring, Md.)

CANADA: Dow Corning Silicones Ltd., Toronto
GREAT BRITAIN: Midland Silicones Ltd., London
FRANCE: St. Gobain, Paris

How does it compare with

WHAT IS AAAC?

AAAC is a high-strength, high-electrical conductivity heat-treatable aluminum-magnesium-silicon alloy developed by Kaiser Aluminum. Through the combination of proper heat treatment and cold reduction, wire is produced having exceptional mechanical strength yet with electrical conductivity only moderately reduced from that of pure E.C. aluminum.

HOW DOES AAAC COMPARE IN EFFICIENCY?

$$\frac{\text{Tensile Strength} \times \text{Conductivity}}{\text{Specific Gravity}}$$

The above formula may be looked upon as a rough criterion for conductor metal efficiency in high tensioned overhead line construction. Using this efficiency criterion, AAAC is:

1. almost 50% more efficient than hard-drawn copper
2. almost twice as efficient as E.C. aluminum
3. about 25% more efficient than ACSR.

DOES AAAC HAVE INSTALLATION ADVANTAGES?

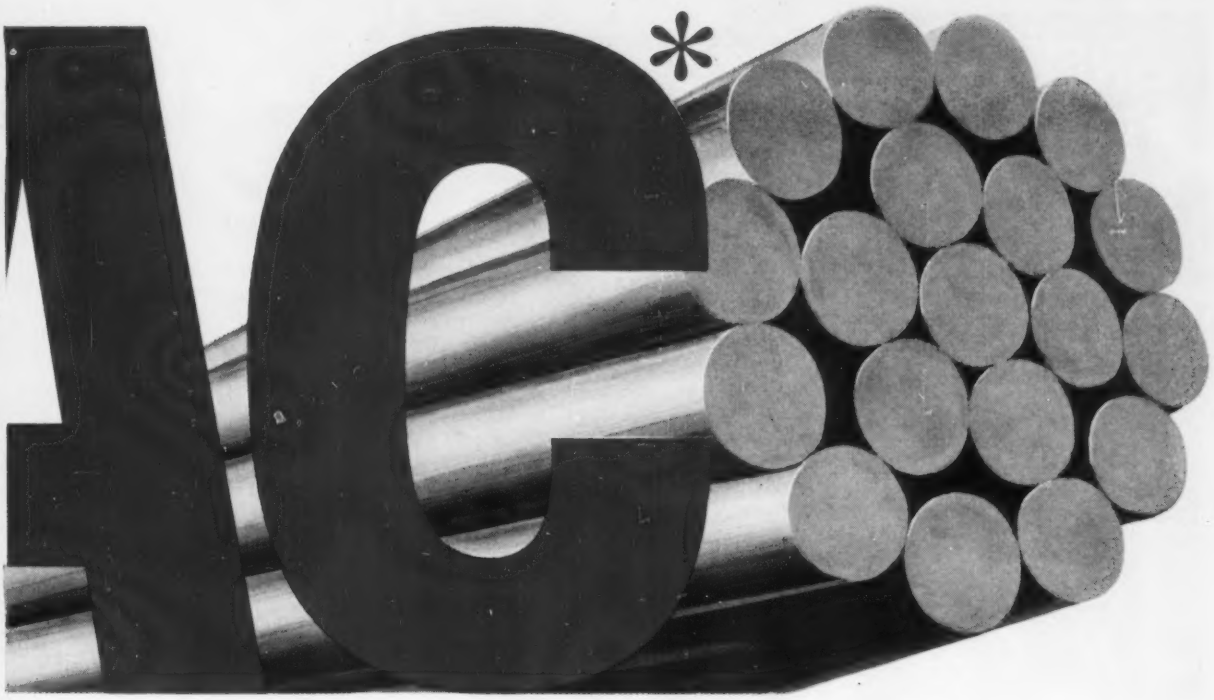
AAAC is as simple to splice and dead-end as all-aluminum or copper cables. For splicing, *only a single compression sleeve is required.* This eliminates the separate steel sleeve, and the cutting back of strands necessary when splicing ACSR. Automatic or preformed splices can develop the full strength of the conductor without special preparation. For dead-ending, suitable bolted-type clamps can develop the full conductor strength. All this means that in many cases fittings will be less costly than those for ACSR, installation time will be less, and rapid emergency repairs may be made more quickly even when the line must remain energized during repair. Armor rods satisfactorily used on ACSR can also be used on AAAC. Repair sleeves, armor rods, clips, Corona balls and dampers are interchangeable because of equivalent sizes.

WHAT ABOUT SIZES?

AAAC is designed in sizes to be approximately equivalent to ACSR conductors (in outside diameter, d-c resistance and breaking strength).

	SIZE	DIAM. (IN.)	STRENGTH (LBS.)	R-DC @ 20°C OHMS/1000 FT.	WEIGHT LBS/1000 FT.
ACSR	6–6/1	0.198	1170	0.6580	36.1
AAAC	6–7	0.197	1068	0.6580	28.2
ACSR	2–6/1	0.316	2790	0.2602	91.3
AAAC	2–7	0.314	2700	0.2602	71.4
ACSR	1/0–6/1	0.398	4280	0.1635	145.2
AAAC	1/0–7	0.395	4290	0.1635	112.4
ACSR	4/0–6/1	0.563	8420	0.0816	291.1
AAAC	4/0–7	0.565	8430	0.0816	232.1

* *The initials AAAC are not a trade-mark of Kaiser Aluminum, but are regarded as a grade designation for All Aluminum Alloy Conductor (developed by Kaiser Aluminum). The initials are intended to be used freely throughout the industry in designating such products, as is the case with grade designation ACSR, Aluminum Conductor, Steel Reinforced. While testing continues AAAC will be available in limited quantities through Kaiser Aluminum sales offices and distributors; redraw rod will later be available to other fabricators of electrical conductor.*



other forms of conductor?

WHAT IS THE CORROSION RESISTANCE OF AAAC?

AAAC is mono-metallic and the alloy has great inherent corrosion resistance. Galvanic corrosion, that may sometimes occur between the steel core wires and adjacent aluminum strands in an ACSR conductor in severe environments, cannot take place with AAAC.

WHAT ABOUT THE OPERATING COSTS OF AAAC?

For the same current carried AAAC will operate cooler than ACSR with a cost-saving and lower watt loss per foot of conductor. Inductive reactance of AAAC at one foot spacings is approximately 10% lower than the equivalent ACSR and, for a given length, will have less voltage drop.

HOW DURABLE IS AAAC?

AAAC has about twice the Brinell hardness of hard-drawn E.C. aluminum. It will, therefore, not abrade so readily as all-aluminum or ACSR conductors during installation nor will it wear to the same extent in ties, dead-ends and clamps.

HOW DOES AAAC COMPARE IN TENSILE STRENGTH?

Since AAAC has the same metal area as ACSR and has the same composite strength, the conductor strength will be the same as its ACSR equivalent. This value is shown in the table where the size comparison is made.

For more detailed information about this important new Kaiser Aluminum development, see any Kaiser Aluminum sales office or one of our many distributors.

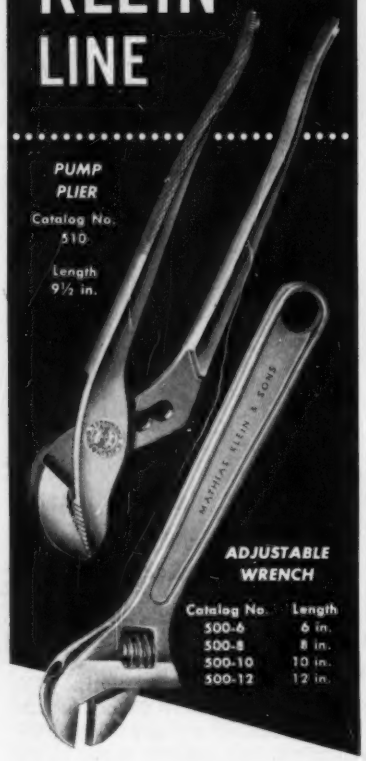
Kaiser Aluminum & Chemical Sales, Inc., *Executive Office,* Kaiser Bldg., Oakland 12, California; *General Sales Office,* Palmolive Bldg., Chicago 11, Illinois.

Kaiser Aluminum

Aluminum is the answer to Adequate Wiring

See "THE KAISER ALUMINUM HOUR" Alternate Tuesdays, NBC Network. Consult your local TV listing.

2 NEW PRODUCTS in the KLEIN LINE



These new high-quality tools have been added to the Klein line.

A Pump Plier that gives easy one-hand operation and a firm grip in any of four positions.

And the new Klein Adjustable Wrenches of drop-forged alloy steel, light in weight, chrome plated for lasting protection and service.

Write for Bulletin

Bulletin No. 1157 on these two Klein tools is now available. Send for your copy.

Mathias KLEIN & Sons
7200 McCORMICK ROAD • CHICAGO 45, ILLINOIS

Phenolic Laminate

(*Continued from page* 188)

perpendicular to laminations, short time test is 200 vpm for 1/8 in., and 150 vpm for 1/8 in; dielectric constant, 1 mc is 4.6; maximum operating temperature is 250 F.

Synthane Corp, Oaks, Pa.

Service Truck Body

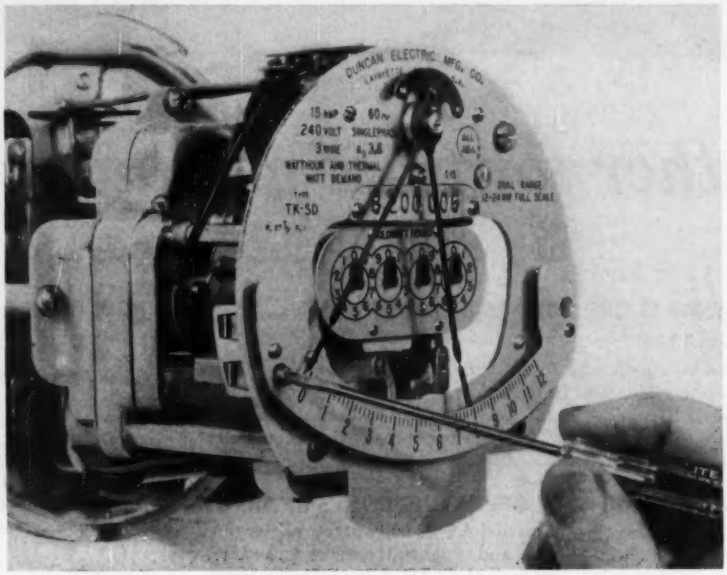
Model UB is the designation given to a recently designed service truck body that is said to incorporate many special features. Included are 15-in. compartments with shelves and trays for holding tools, a 4-ft wide bed with a die-formed, anti-buckling plate floor, double panel doors, and master-keyed cylinder locks throughout. The body is all steel and electrically welded.

Utility Body Co
1530 Wood Street, Oakland, Calif.

Induction Furnace

Two features of Lindberg's "Induc-O-Ring" furnace are said to be interesting and worthy of note: The first is that of using the induction principle in a heat-treating furnace; the second is the circular shape of the induction ring, which reportedly eliminates the usual heat and atmosphere losses occasioned when conventional furnace doors are opened to charge and remove the work load. Circular shape saves floor space.

Lindberg Engineering Co
2450 W. Hubbard Street, Chicago, Ill.



'Dual Range' Thermal Demand Meter

Utilities will note with interest this "Dual Range" thermal demand meter. Manufactured by Duncan Electric Mfg Co, Lafayette, Ind., it is single phase, rated at 15 amp, 12/24 kw for loads up to 100 amp. Designated the TK-SD, it is actually two meters in one, reportedly affording its user savings in equipment, time, and labor.

A range switch in the thermal circuit interlocks with the demand scaleplate in such a manner that the electrical circuit is always correctly connected to the scale used. Changing the scale is accomplished by removing three screws and turning over the scaleplate, one of the screws being the range switch.

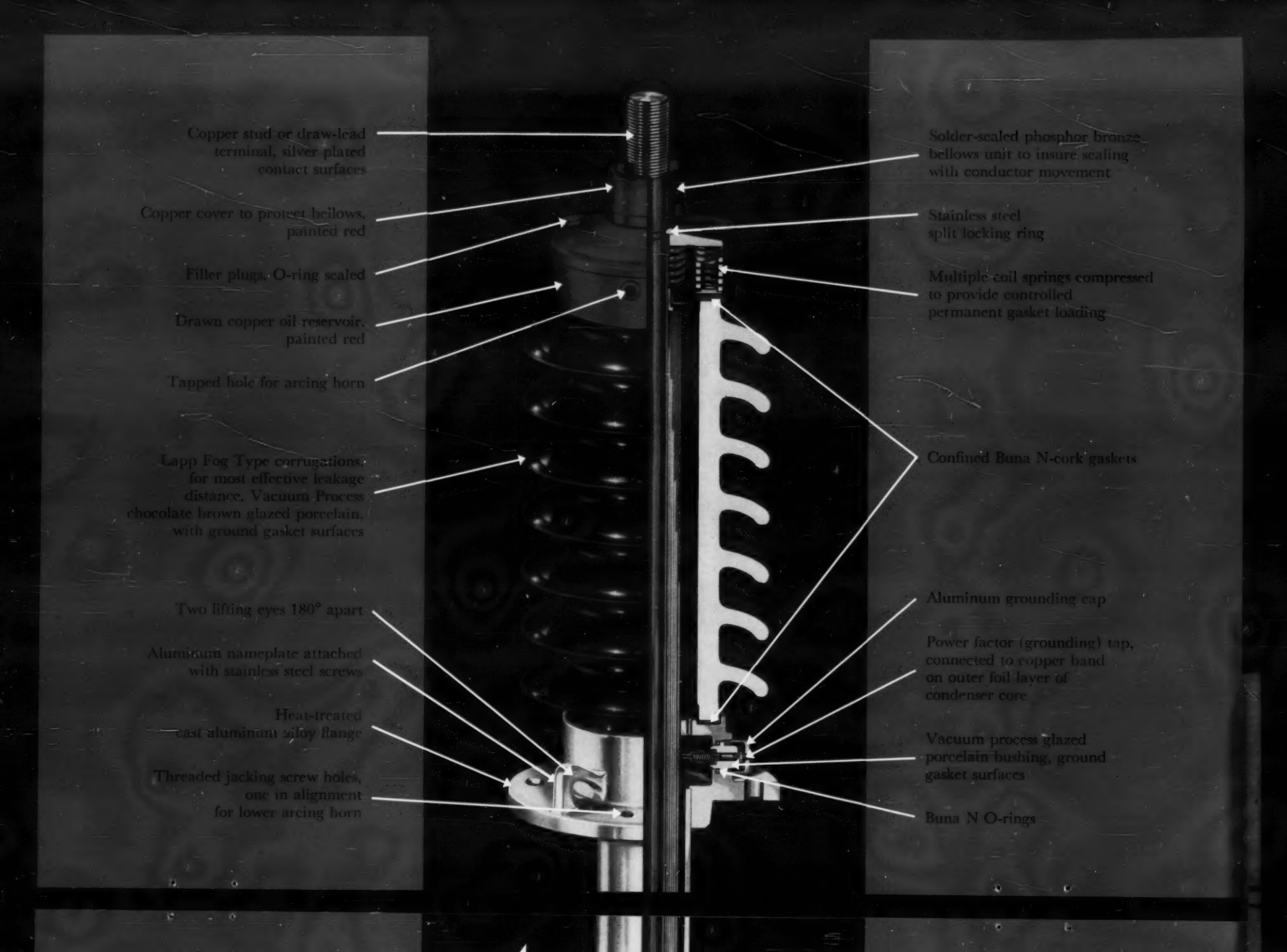
(*More New Equipment on page* 197)

Announcing...

Lapp POC* BUSHINGS

ASA STANDARD

***THE PAPER-OIL CONDENSER TYPE BUSHING THAT BRINGS THE OPERATING SECURITY OF TOTALLY-ENCLOSED MOISTURE-PROOF DESIGN FOR RATINGS 15 kv TO 69 kv**

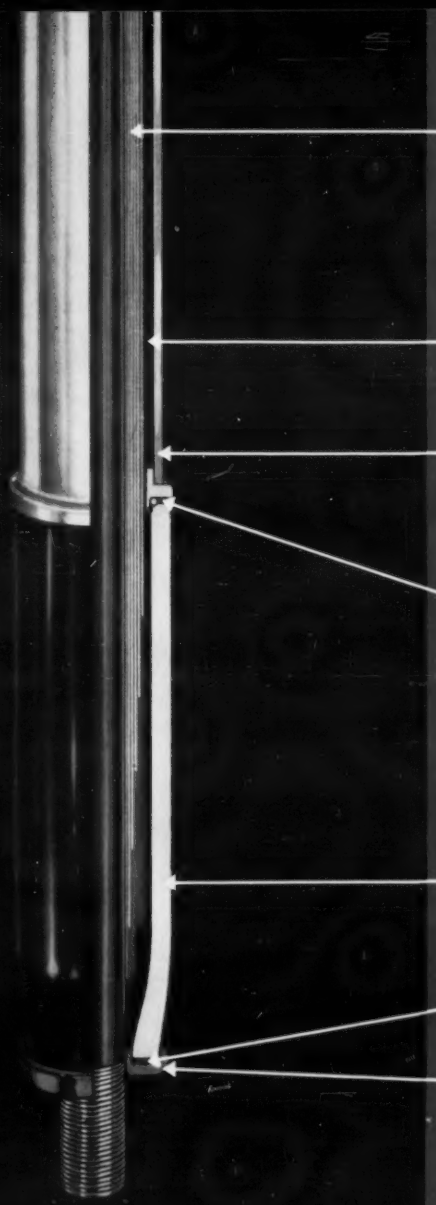

Copper stud or draw-lead terminal, silver plated contact surfaces
Copper cover to protect bellows, painted red
Filler plugs, O-ring sealed
Drawn copper oil reservoir, painted red
Tapped hole for arcing horn
Lapp Fog Type corrugations, for most effective leakage distance. Vacuum Process chocolate brown glazed porcelain, with ground gasket surfaces
Two lifting eyes 180° apart
Aluminum nameplate attached with stainless steel screws
Heat-treated cast aluminum alloy flange
Threaded jacking screw holes, one in alignment for lower arcing horn
Solder-sealed phosphor bronze bellows unit to insure sealing with conductor movement
Stainless steel split locking ring
Multiple coil springs compressed to provide controlled permanent gasket loading
Confined Buna N-cork gaskets
Aluminum grounding cap
Power factor (grounding) tap, connected to copper band on outer foil layer of condenser core
Vacuum process glazed porcelain bushing, ground gasket surfaces
Buna N O-rings

Lapp

POC* BUSHING

***PAPER-OIL CONDENSER TYPE WITH TOTALLY ENCLOSED CORE**

ASA STANDARD



Condenser core, composed of oil-impregnated high dielectric paper, aluminum foil layers, wrapped on solid copper conductor for fixed stud, on copper tubing for draw-lead bushing

Oil space entire length of bushing

Heat-treated drawn aluminum alloy ground sleeve, welded to end castings

Combination gasket—hard Buna N-asbestos gaskets for mechanical loading, Buna N O-ring in precision ground recess for sealing under cantilever loading

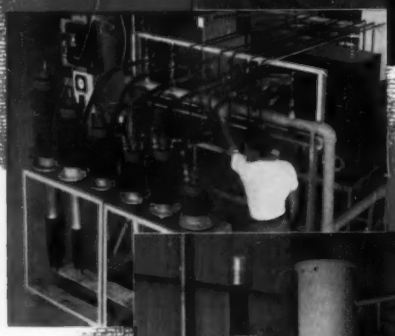
Porcelain ground to close tolerances to cooperate with metal parts for mechanical strength and resistance to impact under breaker duty

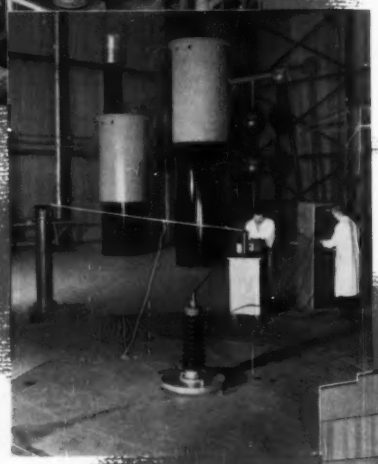
Confined Buna N-cork gaskets

Forged copper cap, threaded and sweated to stud

Lapp POC BUSHINGS

provide the operating security of totally-enclosed moisture-proof design for ratings 15 kv to 69 kv





Paper-oil is the insulation used for bushings, cables and potheads of the highest voltages and where the maximum in reliability and trouble-free performance is essential. To provide the same order of operating security to equipment used at 15 kv to 69 kv, Lapp has adopted this design of construction for its new series of POC Bushings (ASA-NEMA standard).

CONDENSER-TYPE CORE, SURROUNDED BY OIL—The core is a condenser . . . multiple concentric layers of aluminum foil and kraft paper . . . which distributes voltage stress evenly throughout the insulation, to provide maximum insulation in smallest diameter. Impregnated with oil, the core is also entirely surrounded by oil, contained in a full-length porcelain-metal housing.

SPRING-LOADED COMPRESSION SEALING—Porcelain housings are Lapp Vacuum-process electrical porcelain. This inorganic material is non-tracking, will not deteriorate under leakage current. Leak-proof, moisture-proof sealing is accomplished by end-to-end spring-loading of compression gaskets.

COMPLETE RANGE OF RATINGS AND SIZES—In five voltage ratings, 15 kv through 69 kv, Lapp POC Bushings are rated at 1200 amps (with solid copper through-stud) and 400 amps (with draw-lead conductor). Six shank lengths in each voltage class provide for practically all new equipment and replacement needs.

At all rated voltages, Lapp POC Bushings are radio- and television-interference-free. They have a significantly low power factor, essentially unchanging under temperature or voltage variation.

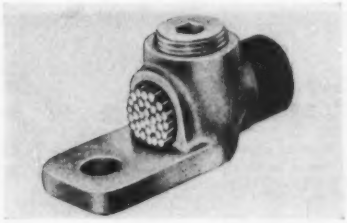
The new Lapp bushing building. High-voltage Laboratory (at left) contains equipment for 60-cycle testing to 1,050,000 volts, impulse testing to 2,250,000 volts, high-current testing to 10,000 amps. The section of the building at the right is devoted to core-winding, processing and assembly of oil-filled bushings.

Lapp

WRITE for Bulletin 508 . . . complete description, specifications and characteristics of Lapp POC Bushings.
Lapp Insulator Co., Inc., LeRoy, N. Y.

Trough Barrier Strips

Barrier strips, according to the manufacturer, provide a quick, economical method of dividing cable trough for segregating cable. A right-angle bend (illustrated) is included in a newly redesigned line of such strips. Straight runs in 8, 10 and 12-ft sections, as well as 90, 60, 45 and 30-deg flat elbow blends are available. The line also has 90, 60, 45 and 30-deg riser elbow sections, each with inside or outside bends. The troughs are made of expanded metal.
T. J. Cope, Inc, Collegeville, Pa.



Lug Connector

A number of important improvements have been incorporated in a lug, according to the manufacturer. A circular boss to which the insulation butts flush in full circle is said to give a snug fit and make for easier taping. Greater contact area with the conductor and serrations for higher resistance to horizontal pull are among other features. These connectors are available in 7 sies from 500-100 Mcm to 14 solid 8 strand.
Penn-Union Electric Corp,
315 State St, Erie, Pa.

Lamp Transformer

A constant wattage mercury vapor lamp transformer for outdoor operation of two H1 400-watt lamps reportedly provides the features of transformers for single-lamp operation: limitation of line current surge during starting period to no more than full load value; regulated lamp wattage and light output; open-circuit protection; no light outages experienced with severe line dips, and the elimination of primary taps. Manufacturer claims reliable starting and operation in temperatures down to −30 F.

Arranged for convenient mounting by any of the common means, the unit's dimensions are: height 13⅞ in.; case diameter 9¼ in.; and weight approximately 70 lbs.
Sola Electric Co, 4633 West 16 Street, Chicago 50, Ill.

Portable Rotary Hammer

This portable electric rotary hammer uses shock waves as a drilling force. Creating over 36,000 shock waves a minute, it is said to be capable of cutting a hole from ⅞ in. to 1½ in. diameter up to 40 ft in depth through stone, rock or reinforced concrete. It weighs approximately 10 lb, and reportedly requires no pressure. Operates on 115-v ac or dc at 1,000 rpm, and requires no rectifier. Hammer measures 16 in. and delivers 6,000 blows per minute. Literature is available.
Demo-Haines Tool Corp
N. 10th Machine Works, Enid, Okla.

(*More New Equipment on page* 200)

What are YOUR RECTIFIER REQUIREMENTS

- **Selenium?**
- **Germanium?**
- **Silicon?**

You get all these *pluses* when you use Walker Rectifiers: low DC ripple — about 4% . . . low cost . . . long, efficient life . . . no maintenance. All Walker Rectifiers are designed and built to the highest standards, with the highest quality components.

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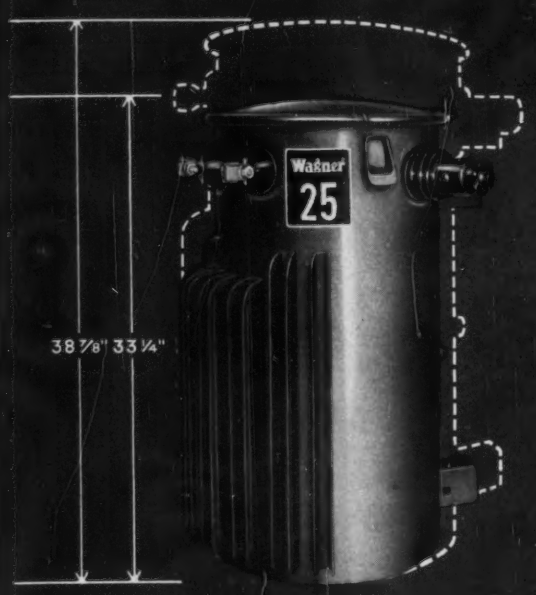
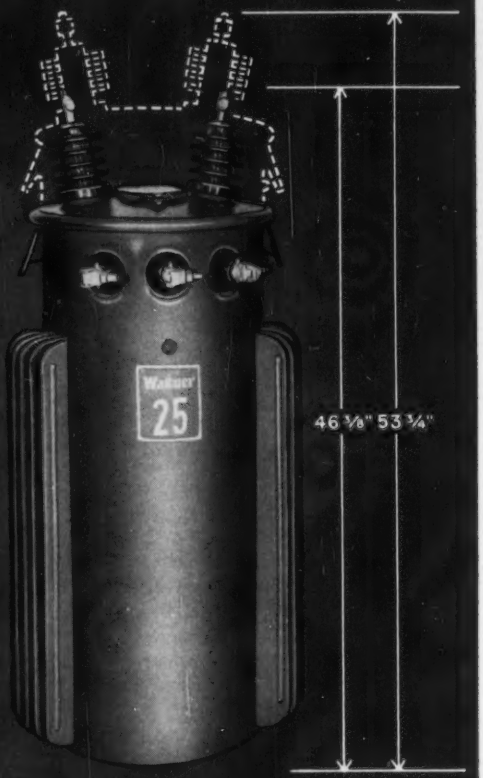
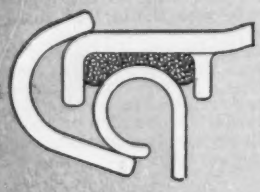




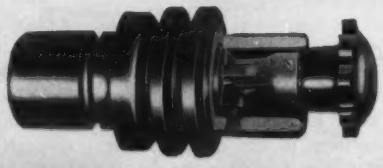
SHUR-SEAL CLAMPING RING



Keeps transformer sealed air-tight ... no atmospheric moisture or dust particles can get inside. Spring action of lip and ring maintain pressure on gasket. Cover may be removed by loosening a single bolt.

HIGH VOLTAGE SIDEWALL BUSHING

For use with either copper or aluminum conductor ... safety-designed for faster, easier connections, without tools. Porcelain and terminal are locked in position.



MECHANICAL FEATURES

The rating of each of these new transformers is clearly shown on the tank. There are fewer sharp edges and brackets on the tank where rust can start ... lifting lugs are curved and rounded.

In the 25, 37½ and 50 Kva ratings, cooling fins increase the radiating surface. The 75, 100 and 167 Kva ratings are provided with tubes.

Wagner

Distribution Transformers
smaller-lighter-easier to handle and install

Now Wagner Form W Distribution Transformers are substantially smaller and lighter than ever before... up to 25% shorter in the important overall height dimension—17% lighter in weight. Yet they are liberally designed for excellent electrical performance.

This means greater ease of handling—speedier installation. It also means that you can save money by putting greater transformer capacity on your existing structures... handle heavier loads without installing new poles. All these new Form W Transformers, in ratings 15 through 167 Kva, 15 KV and below, can be pole mounted.

Such reductions in size and weight are made possible by improvements in core and coil construction. A special resin coated insulating material is used for layer, channel and barrier insulation. Heat treating bonds this insulation to the coil conductors to give the coils exceptionally high mechanical and electrical strength.

These new, lighter shorter Form W Transformers will meet your distribution requirements. Consult the Wagner Sales Engineer in your area for complete information.

LOCKED LOW VOLTAGE BUSHING

The bushing and terminal are key-locked to prevent rotation... no loose terminal connections to cause internal shorts. Suitable for copper or aluminum conductor.

INHIBITED OIL

—reduces oxidation to a minimum... retards formation of acids and sludge.

Wagner Electric Corporation
EST. 1891

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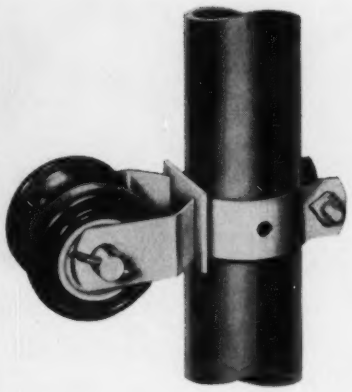
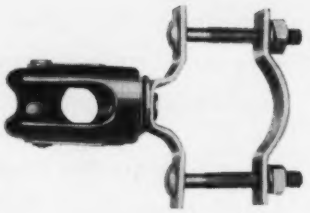




Service Deadends

Two service entrance brackets, designed for ranch-type houses, are said to provide sturdy, inexpensive methods for deadening service drops. The "wireholder" type deadend accommodates standard service wires and can be mounted on rigid conduit of 1¼ through 2½ in. IPS. The "spool" type, consists of a cleavis and spool insulator, and provides a large radius for heavy conductors. It can be mounted on a 2 or 2½ in. rigid conduit.

Line Material Co, 700 W. Michigan Street, Milwaukee 1, Wis.

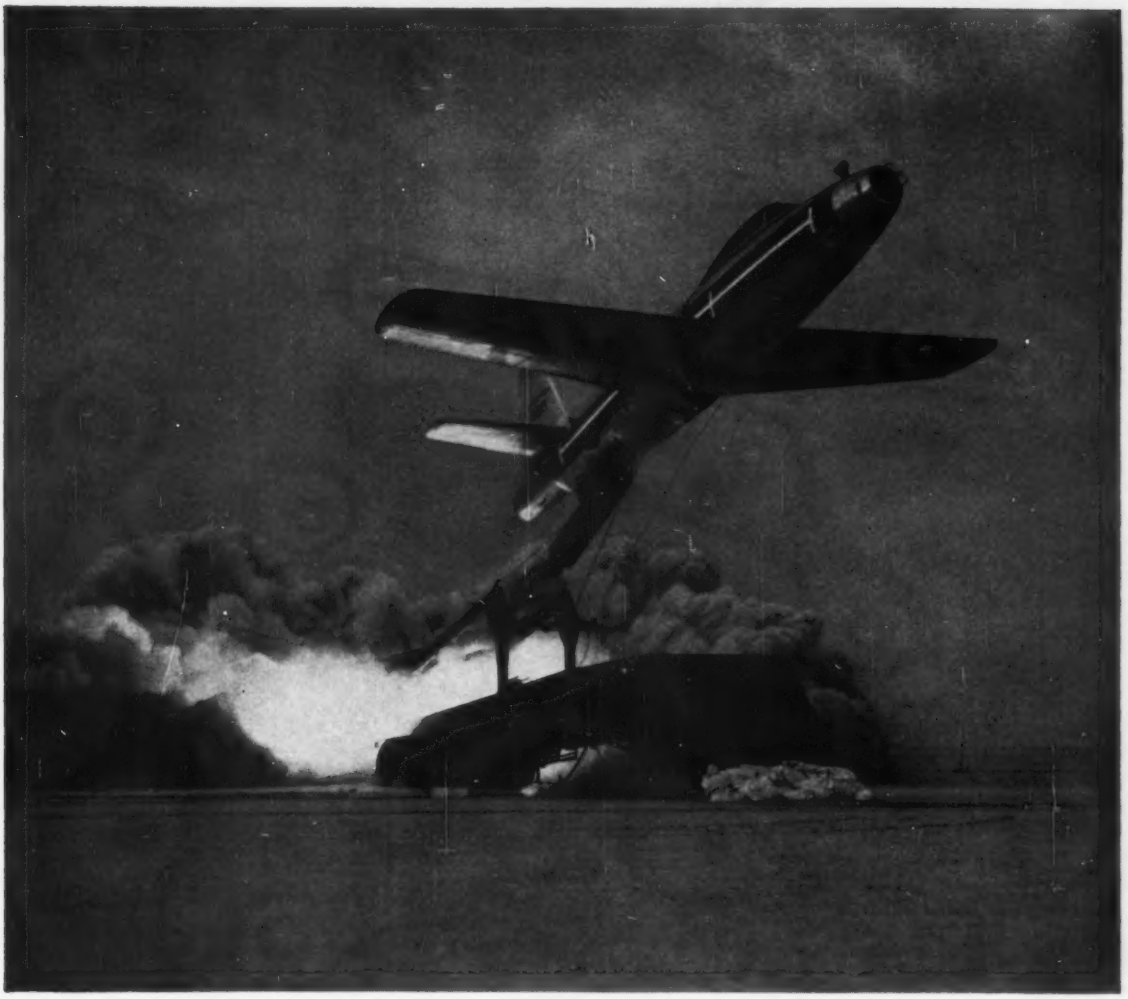
Silicone Insulation Tape

A silicone glass cloth electrical tape has been developed that is said to be suitable for Class H insulation. Designated Permacel 211, it is reported to have about 580 dtm dielectric strength and the ability to withstand temperatures to 550 F.

Backing of Permacel 211 is silicone varnish treated glass cloth. The silicone adhesive is both heat cured and pressure sensitive. Its over-all thickness is 6 mils. Available in 60 yd rolls, in widths from ¼ to 1 in.

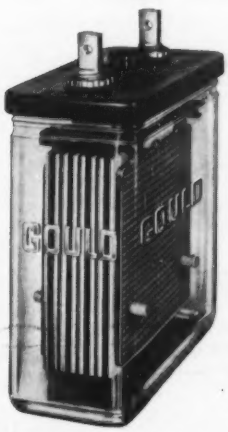
Manufacturer recommends the tape

(*Continued on page* 204)



Get off to a good start...

specify **gould** **BATTERIES**



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More and better battery performance.

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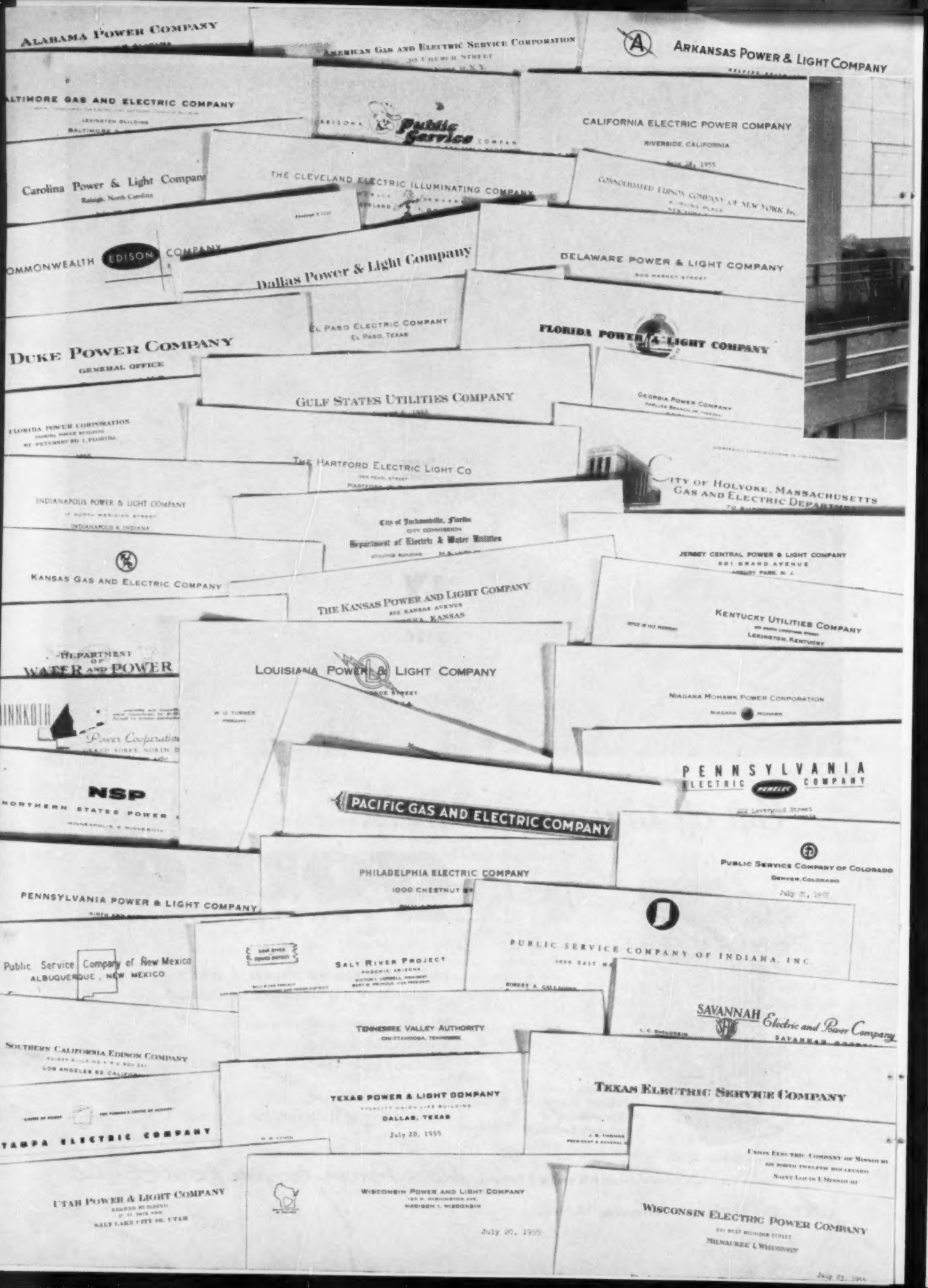
More Power to you from Gould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AMERICAN GAS AND ELECTRIC SERVICE CORPORATION
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ARKANSAS POWER & LIGHT COMPANY
ALTIMORE GAS AND ELECTRIC COMPANY
LEXINGTON BUILDING
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WISCONSIN POWER AND LIGHT COMPANY
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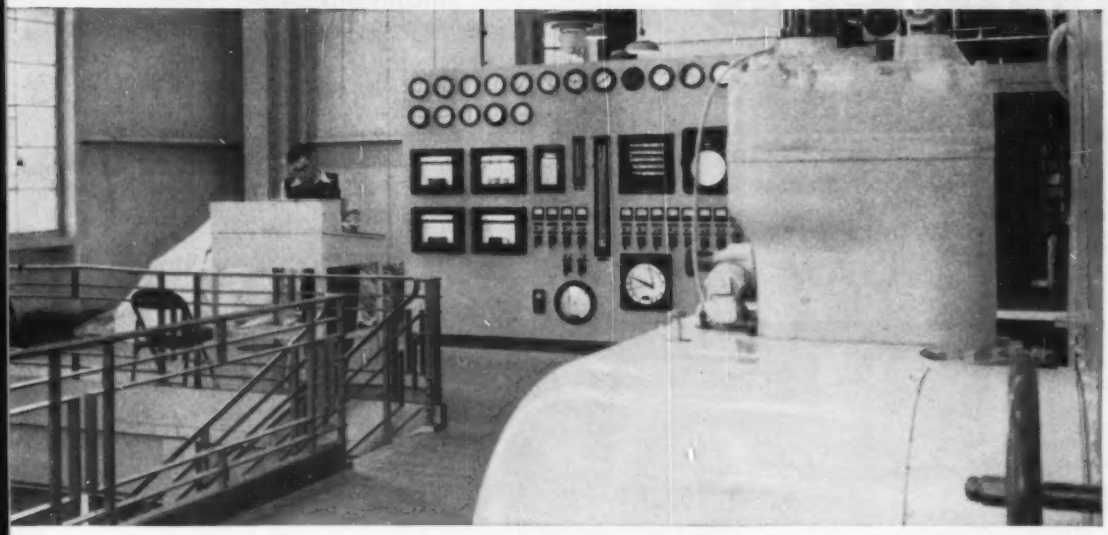
WISCONSIN ELECTRIC POWER COMPANY
MILWAUKEE 1, WISCONSIN



Typical installation of Honeywell supervisory instruments for a 60,000-kw turbo-generator at the Tyrone, Kentucky plant of Kentucky Utilities Company.

YOU'RE IN GOOD COMPANY

when you choose . . . Honeywell instrumentation

You join America's best-known public utilities when you choose instrumentation by Honeywell. You'll find Honeywell instrumentation everywhere . . . in large stations and small. The reasons for this are clear.

With the precision, stamina, and reliability of Honeywell instruments, you get an important extra . . . service. This service begins with your first plans, and continues long after your instruments are installed. It includes:

Application engineering of instrumentation, custom-fitted to your plant by a staff experienced in power station measurement and control.

Installation and startup assistance by Honeywell service engineers.

Maintenance engineering, in emergencies or on a periodic service schedule, by factory-trained specialists located near you . . . in the more than 112 Honeywell offices in the United States and Canada.

Quick shipment of spare parts, from your local Honeywell branch office or from the Parts Depot in Philadelphia.

Training of your instrument men in up-to-date maintenance at the tuition-free Honeywell Education and Training Center in Philadelphia.

These are but some of the benefits you gain when you add your company's name to the list of prominent companies using Honeywell instrumentation. Get the full story from your nearby Honeywell sales engineer. He's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

H HONEYWELL

MINNEAPOLIS **Honeywell**

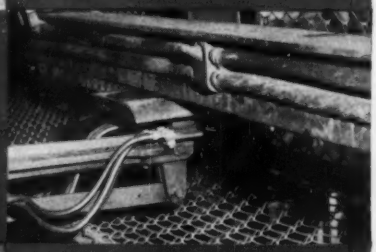
BROWN INSTRUMENTS

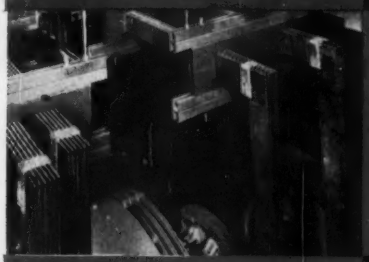
First in Controls

CADWELD
connections....
4 ways better

1 PERMANENT
Outlasts the conductor.

2 FULL LOAD CAPACITY
Greater current carrying capacity than the conductor.





3 CANNOT LOOSEN OR CORRODE
No bolts to maintain — uneffected by surge currents.

4 PORTABLE EQUIPMENT
Ideal for field work — requires no source of outside power.

CADWELD®

Erico Products, Inc.

2070 E. 61st Place Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario

Silicone Insulation Tape

(*Continued from page* 200)

for holding and insulating wires of transformers, coils, motors and generators, various types of heating elements, and as protection against molten solder in solder-dripping operations.

Permacel Tape Corp
New Brunswick, N. J.

More New Products

Benjamin Electric Mfg Co, Des Plaines, Ill., offers three advanced **industrial lighting systems** that are said to embody distinctive design and construction features which add to each system's sustained efficiency, while reducing maintenance and operating costs.

H. K. Porter, Inc, Somerville, Mass., offers a heavy-duty **metal cutter** for cables, wire, wire rope, rods and bolts. Comes in two sizes, and utilizes only hand power. Reportedly can be easily attached to a bench, truck, machine, floor, etc.

Phoenix Electric Mfg Co, 4211 W. Lake St, Chicago 24, Ill., offer a line of high-temperature **brush holders** molded of "Pemester." They are claimed to have high dielectric strength, high impact resistance, and freedom from distortion at temperatures up to 400 F.

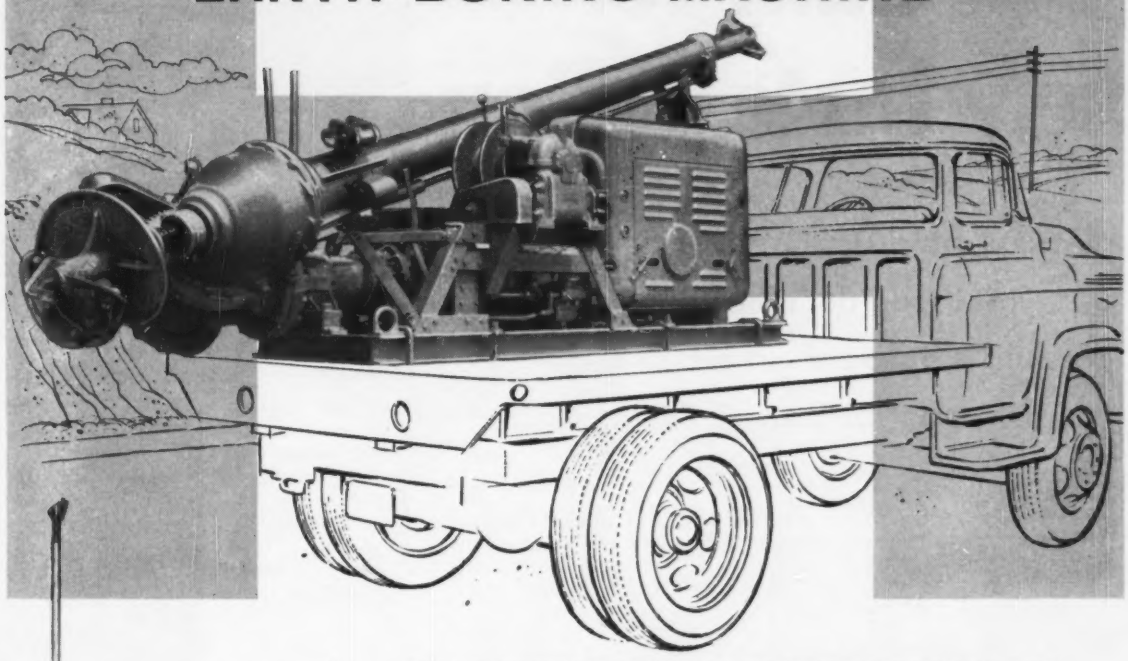
Harvey Hubbell, Inc, Bridgeport, Conn., has introduced a lock-type **connector** that reportedly has some new advantageous features. While the locking principle of the new connector remains the same as that of older ones, it utilizes a screwless pressure grip terminal design which is said to eliminate the need for binding posts and to reduce wiring time by a third. It is smaller and lighter. Called "Super Twist Lock," it is available in a variety of 2-, 3-, and 4-wire sizes.

Gulton Industries, Inc, Metuchen, N. J., have a series of **ultrasonic transducers** available for a variety of cleaning and processing applications. Designated "Glennite Series UT-10," the transducers are for use with ordi-

(*Continued on page* 208)

easy to put on . . .
easy to take off!

HIGHWAY'S SKID-MOUNTED
EARTH-BORING MACHINE



Exclusive!

Highway Telescoping Derrick

The telescoping derrick (3500-lb. capacity) can be extended 28 ft. 6″—derrick retracts for convenience of operation. Available as optional equipment on the Model "HC" and "HCMS" machines.

Digs the Hole and Sets the Pole in any Soil!

Here's a heavy-duty earth-boring machine with mounting versatility seldom found in such a rugged unit. Highway's HCMS skid-mounted earth borer can be truck-mounted, tractor-mounted, or mounted on almost any type of conveyance.

ECONOMY OF OPERATION — The versatile skid-mounted unit eliminates costly mounting charges. The entire machine can be quickly mounted or removed from the platform, allowing the vehicle to be used for other work.

A COMPLETE UNIT — the HCMS is integrally assembled with clutch, transmission and a long-life Continental Red Seal 226-cubic-inch engine. It digs holes from 9″ to 36″ in diameter in any soil condition — even in rock when equipped with a special auger.

DIGS AT ANY ANGLE UP TO 90° at right angles to the vehicle and up to 60° in line with it. Leveling mechanisms permit quick adjustment to dig vertical holes regardless of vehicle position. Your choice of platform or ground control allows full visibility and automatic safety.

SETS BIG POLES with your choice of integral winch and derrick or completely automatic telescoping derrick.

HIGHWAY

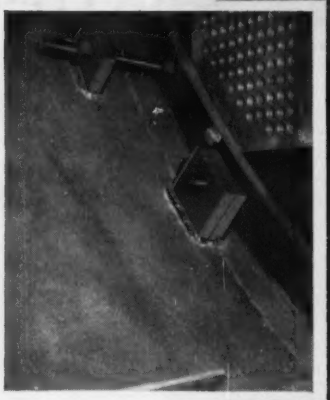
A Division of the Equipment Department, Marmon-Chapman & Scott Corp.

UTILITY DIVISION
HIGHWAY TRAILER COMPANY
Headquarters: EDGERTON, WISCONSIN

Manufacturers of Public Utility Bodies • Earth-Boring Machines • Pole and Cable Reel Trailers • Winches • Power Take-Offs • Service Accessories • Commercial Trailers • Trailerized Tanks and Dry Bulk Haulers
SALES AND SERVICE IN PRINCIPAL CITIES

BIG...
but built for easy installation

Unique field assembly and welding methods developed by Allis-Chalmers cut installation costs for Detroit Edison



Pull-up blocks and dowel blocks, shown above, are used to simplify alignment during installation.

Size alone dictated that this huge 115,000-square-foot condenser for The Detroit Edison Company's River Rouge Station be fabricated and shipped in sections. Here's the way this job was handled:

Before shipment, matching joints were machine scarfed for full penetration welds, and sections were carefully fitted together. Each joint was then equipped with "dowel blocks" and "pull-up blocks" as shown in the inset.

The condenser was then disassembled and shipped.

Joint Seal-Welds Eliminated

In final assembly, dowel blocks were lined up . . . pull-up blocks quickly brought sections back to original shop position, snugly, and units were welded. This minimized erection costs. Welding sections together, eliminating the necessity of seal-welds with bolted flange sections, provided a vacuum tight, maintenance-free joint.

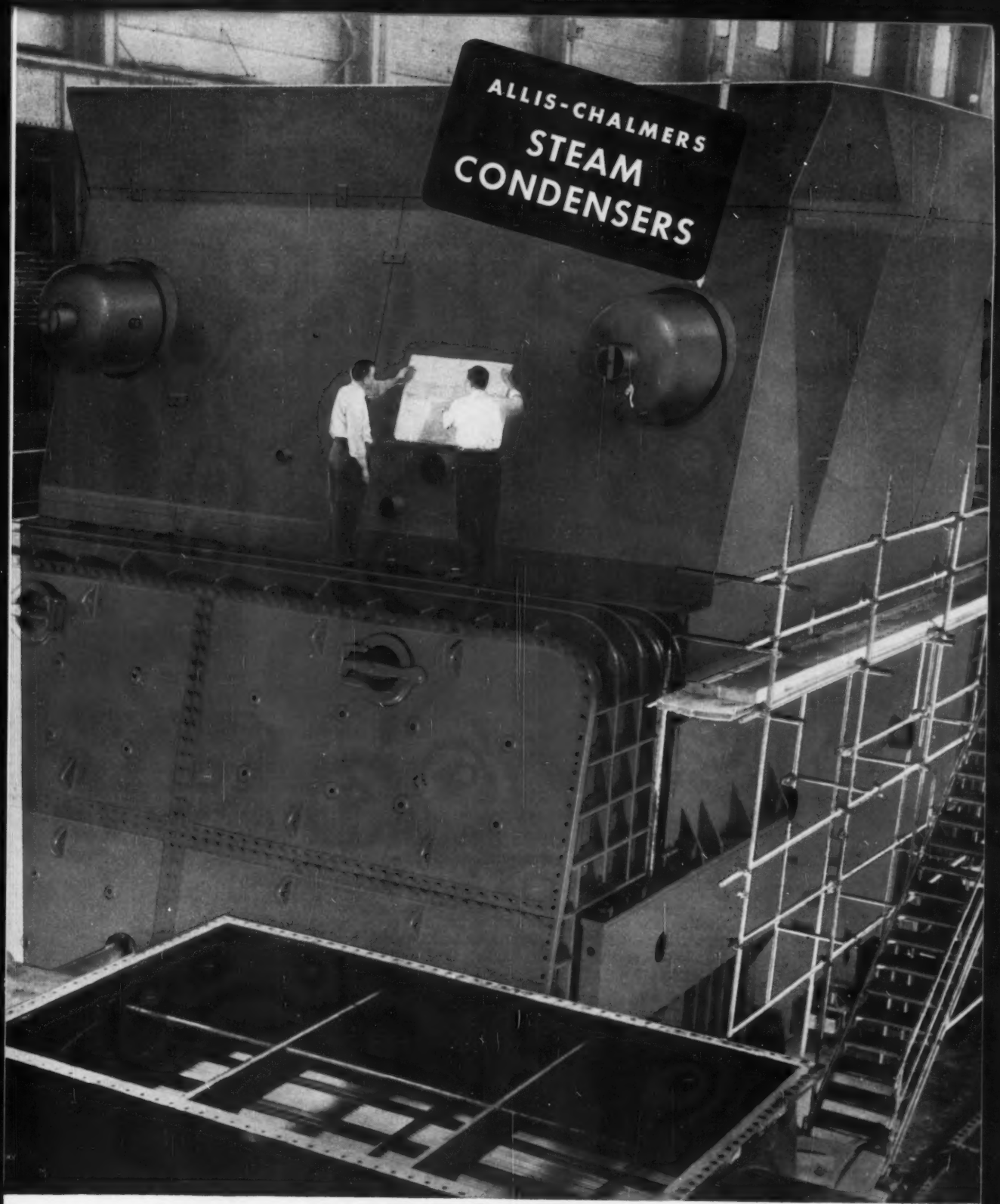
This is typical of the design and engineering extras that you get when you specify Allis-Chalmers condensers.

Get information. Call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Giant 115,000-square-foot condenser of new River Rouge Station.

A-C ALLIS-CHALMERS

ALLIS-



CHALMERS

A-5224

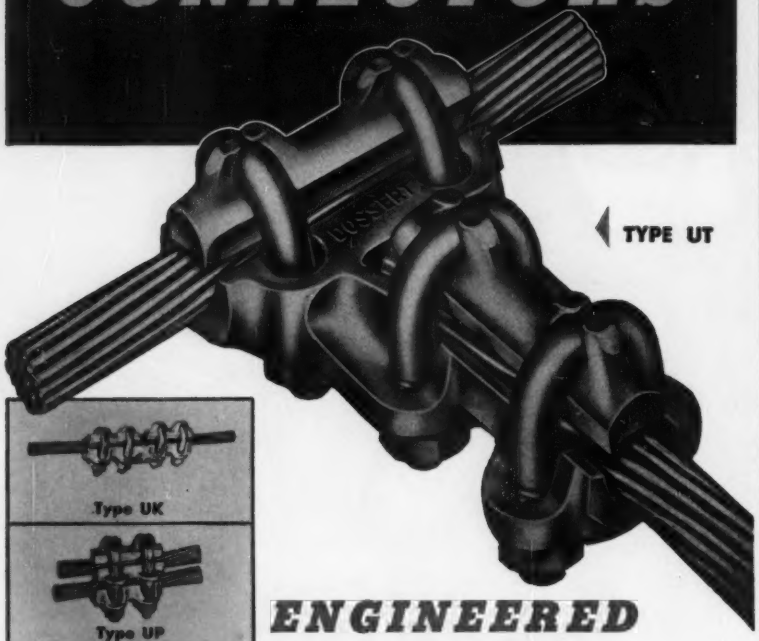
Fast to make fast!

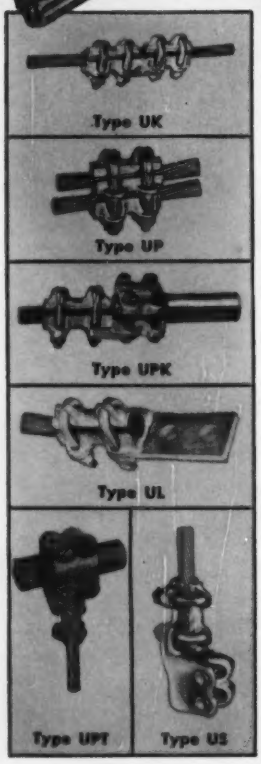
Safe, swift cable connections with

DOSSERT

U-BOLT

CONNECTORS





ENGINEERED FEATURES:

VARIABILITY

Fits many cable sizes, reduces number of connectors needed for given number of combinations of conductors.

HIGH CLAMPING ACTION

U-Bolts clear all conductors by close limits, supported by saddles through their full arcs. Minimizes bending action, makes U-Bolts subject to tensile stress only.

CABLE END RELIEF

Allows for distortion in free ends of strands, ample room for binding end of stranded cable if desired.

CONDUCTIVITY

High copper alloy with sufficient contact area to insure cooler-than-conductor operation under maximum load.

Available for aluminum or aluminum to copper conductors.

Excl. Canadian Distributor: W. S. Gerrie & Assoc. Ltd.
66 Racine Road, Rexdale, Ontario

50 YEARS OF TECHNICAL KNOW-HOW

WRITE FOR DETAILS AND PRICES TODAY!

DOSSERT MFG. CORP.

249 Huron Street, Brooklyn 22, N. Y.

More New Products

(*Continued from page* 204)

nary organic solvents, aqueous solutions, mild acids, alkalis and detergents. They have a rated power of 250 w, a maximum operating temperature of 155 F, and are available in ½ and 1-qt sizes.

General Electric Co, Schenectady 5, N. Y., has a 4-lamp, 6-ft **fluorescent luminaire,** designated Form 406S, that is said to produce 21,200 lumens and features a slipfitter mounting.

Stromberg-Carlson Division of General Dynamics Corp, Rochester 3, N. Y., has developed a high speed **recording device** that is said to be able to enter data from electronic computers at a rate that would transcribe the data from a 300-page book in 30 seconds.

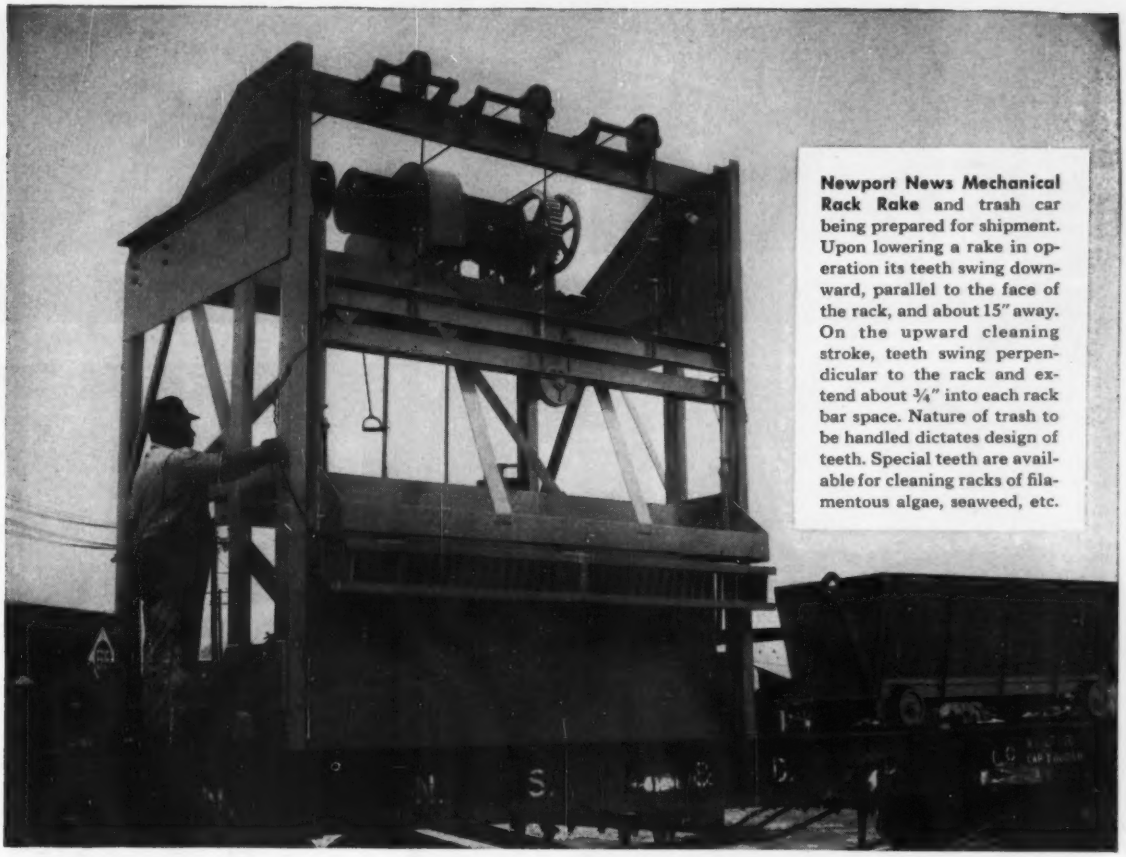
Micro-Switch, Freeport, Ill., offers a **rotary toggle switch** that reportedly solves the problem of controlling many circuits with a single-motion mechanical actuation. Designated 4TRI, it is said to be able to handle a high electrical load and be rugged enough for most industrial applications. 12 terminals; other models available with up to 24 terminals.

Arnold O. Beckman, Inc, 1020 Mission Street, South Pasadena, Calif., has added a portable, self contained **oxygen analyzer** to their line of intruments. Called Model D2, it may be used for measuring oxygen in almost any mixture of gases; its accuracy is said to be unaffected by the other gases in the mixture. Range is 0 to 25% 0_2, with a reported accuracy of $\pm 0.5\%$.

American Solder & Flux Co, 19th & Willard Streets, Philadelphia, Pa., has developed a **mild flux** intended for electrical work where a strong, corrosive flux cannot be used. Called "Neutral White Flux," it is available as a paste or liquid.

DuMont Laboratories, Inc, Clifton, N. J., offer a **mobile radio communications unit.** Designated the NCA-110-B, the vibrator powered unit is said to offer 60 to 75 kw across its entire band —25 to 54 mc.

(*More New Products on page* 212)



Newport News Mechanical Rack Rake and trash car being prepared for shipment. Upon lowering a rake in operation its teeth swing downward, parallel to the face of the rack, and about 15" away. On the upward cleaning stroke, teeth swing perpendicular to the rack and extend about ¾" into each rack bar space. Nature of trash to be handled dictates design of teeth. Special teeth are available for cleaning racks of filamentous algae, seaweed, etc.

Positive cleaning action calls for guided rack rakes

Excessive loads of trash cannot push a Newport News rake away from the racks.

And there's no chance of the rake *riding over trash* on the upward cleaning stroke. Nor will its teeth drop the debris. Because Newport News builds the rake to operate in channel guides... for *positive cleaning action.*

That's why efficient rack cleaning assures the maximum head at intakes and is yours when you put a rugged and dependable Newport News Mechanical Rack Rake on the job.

Maximum width of a single rake is determined by design of the forebay. Where a single bay is extremely wide, intermediate guides are sometimes installed to reduce width of the rake. Such installation is relatively inexpensive.

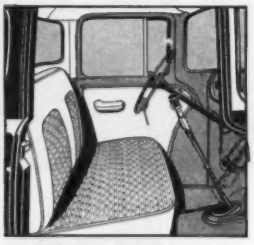
A power-operated Newport News Mechanical Rack Rake, under ordinary conditions, enables one man per shift to keep racks clean for a dozen bays, from 5'-6" to 28'-6" in width.

Trash is cleaned from the rake manually, or by a mechanical "sweep", into a flume, a car or onto a trash apron. Local conditions and nature of the trash dictate method of disposal. The many typical installation arrangements fit most needs, but each installation is a custom built job.

We invite inquiries from water users who are troubled with trash. Write for your copy of "RACK RAKE", an illustrated booklet describing the operation and advantages of the Newport News Mechanical Rack Rake.

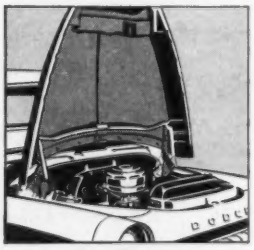
Newport News
Shipbuilding and Dry Dock Company
Newport News, Virginia

FIRST NEW



NEW COMFORT CABS

Industry's largest, for real stretch-out comfort. All-new seat design permits adjustment of back cushion and seat height, plus normal slide positioning.



FULL-OPENING HOOD

Exclusive!—Can be raised full 90° for easiest, fastest engine servicing, half-way for routine oil and water checks.

Stake models up to 21,000 lbs. G.V.W.

SHOWING

DODGE

PowerGiants

- **NEW giant-power V-8 engines!**
- **NEW push-button driving!**
- **NEW higher load capacities!**
- **NEW *Forward* Look Styling!**

Get set to profit from a great *new* kind of truck—with *more* V-8 power and *more* payload capacity—with *more* eager-to-go snap than any other make on the road!

From 204-hp. pick-ups to 232-hp. tandems, today's new low-priced V-8 Dodge *Power Giants* deliver more truck per dollar—and more profitable payloads—in *every* weight class, 4,250 lbs. G.V.W. to 65,000 lbs. G.C.W.

New short-stroke Chrysler-engineered V-8's—with exclusive Power-Dome combustion—give you more miles per gallon, full power on *regular* gas. Increased power in famous, dependable Dodge 6's, too.

Push-button automatic transmission is still another great plus you get only in new Dodge *Power Giants.** First in any truck! Simple, sure, trouble-free. Just push a button, shifting is automatic.

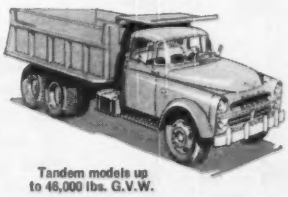
Test-drive a Power Giant—V-8 or 6—soon! Get your Dodge dealer's deal *before* you decide on your new truck.

**Available on low-tonnage and forward-control models.*

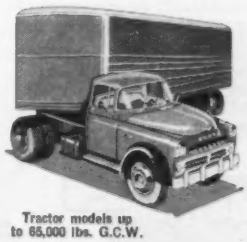
DODGE TRUCKS

WITH THE *FORWARD* LOOK

4 pick-up models up to 8,800 lbs. G.V.W.



Tandem models up to 46,000 lbs. G.V.W.



Tractor models up to 65,000 lbs. G.C.W.

4-wheel-drive models up to 18,000 lbs. G.V.W.

Smooth "Pulley Action" Wireway Prevents Conductor Chafing
Extra-Sturdy Copper Rivet
Large 1" x 7/8" Hole
Heavy Steel Cup-Base and Yoke A Single Hot Dipped Galvanized Steel Stamping
Two Holes In Base Assure Effective Drainage
No. 22 X 2¼" Hot Dipped Galvanized Screw Assembled Solidly and Rigidly to Steel Base
Extra Sharp Threads and Quick-Starting Point Make Driving Easy

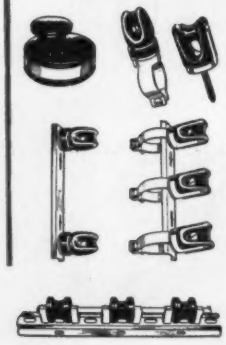
RUGGED DURABLE DEPENDABLE

PORCELAIN PRODUCTS WIREHOLDERS

AND SECONDARY SERVICE MATERIALS

Where *quality* and *performance* are necessary for continuous line service—Porcelain Products wireholders and secondary service materials *assure* reliability. They're engineered with strong, sturdy construction—metal in tension, porcelain in compression. Steel parts are hot-dip galvanized . . . screw threads are extra sharp, lubricated for ease of installation. Larger, pulley-action wire hole, for large wire sizes—prevents chafing, wire wear.

These EXTRA features—*plus*—Porcelain Products "Quality Line" reputation, make an unbeatable combination . . . SPECIFY PORCELAIN PRODUCTS wireholders and secondary service materials.



62 Years **Porcelain Products, Inc.** PP INC.
FINDLAY, OHIO

More New Products

(*Continued from page* 208)

Clark Controller Co, Cleveland, Ohio, has the following:

A line of 10-amp **control relays** that are said to save space, available with from 2 to 12 poles, including up to 8 poles for double-decking.

Two limit switches, one for heavy-duty machines, which features complete separation of electrical and mechanical mechanisms and nylon-to-steel surfaces; the second switch is especially designed for synchronization of multiple operations.

An **air valve** for the protection of operators of air-operated presses having clutches or brakes.

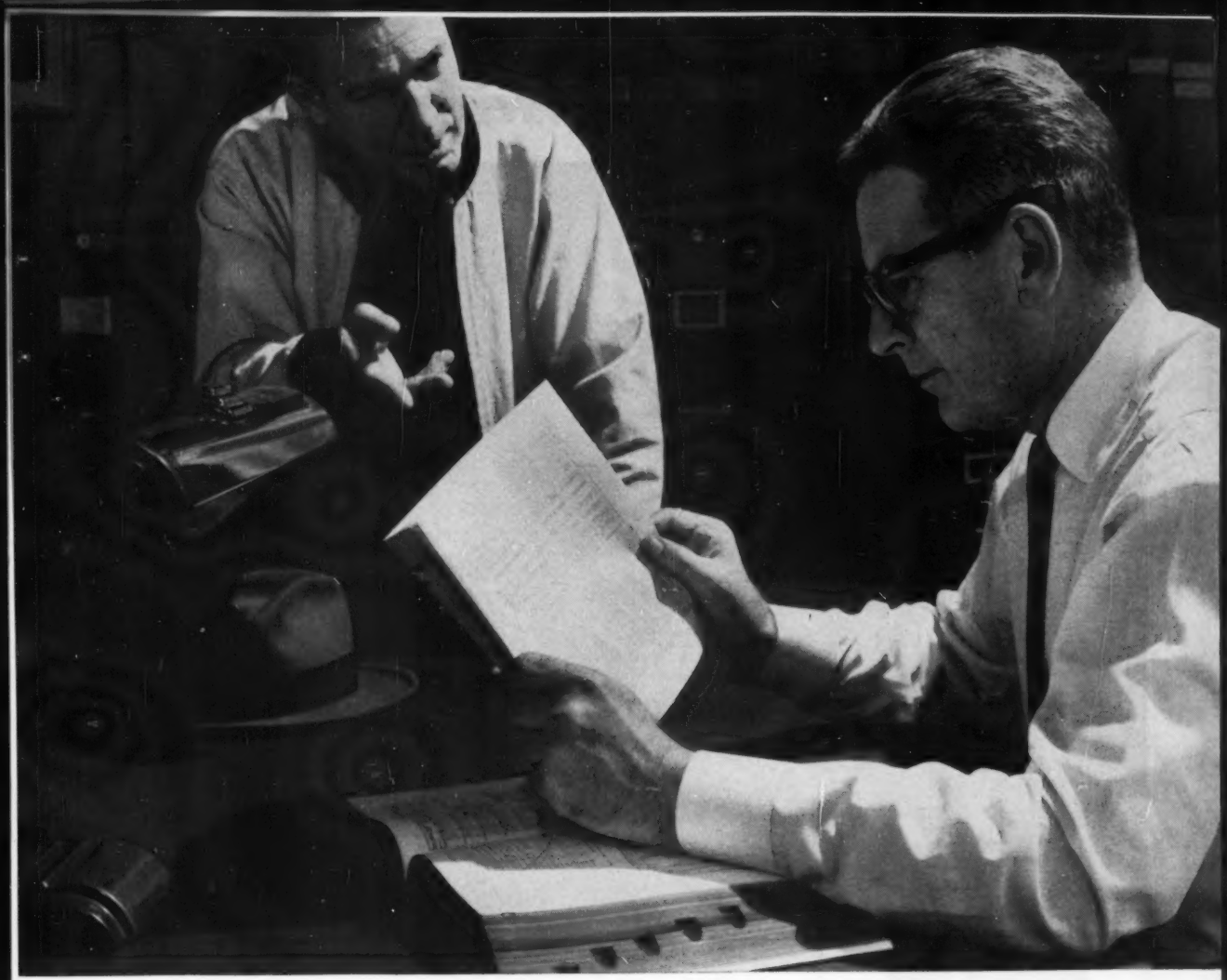
Minnesota Mining & Mfg Co, St. Paul, Minn., has a spring type electrical **wire connector** that reportedly makes solderless, ready-insulated splices in one step without tools. Called "Scotchlock," it is said to provide a vibration-resisting pig-tail splice that holds regardless of thermal or mechanical changes.

Metals & Controls Corp, Attleboro, Mass., has developed **Tin Clad Nickel Strip,** a composite metal of pure tin solder clad on one side only to pure electronic grade nickel. It is said to be suitable for any application requiring closer tolerances and layer uniformity than hot strip.

Sylvania Electric Products Inc, Wheeling, W. Va., announced the development of a 4-ft **fixture** the Firm's VHO (very high output) fluorescent lamp.

North American Philips Co, Inc., 750 S. Fulton Ave, Mount Vernon, N. Y., has a 100 kv **electron microscope.** Designated Model EM-100B, it features a hinged objective lens, magnetic compensator, objective diaphragm with multiple apertures and an insert screen with binoculars for ultra thin specimens.

Powers Regulator Co, 3434 Oakton Street, Skokie, Ill., offers an **electrically-operated air valve** that is said not to hum, talk or chatter. When electrically energized, the valve will pass full air at supply pressures up to 25 psi. A 60-cycle coil can be supplied for voltages of 115, 208, 230, or 440.



Steve's writing new pole specifications because...

PENTA-treated poles last longer, handle easier

As construction and maintenance superintendent, I'm plenty interested in knowing that we're using the best materials we can get. Saves me trouble in installation and maintenance. That's why I went in and asked Steve —he's our specification engineer—how the specs on the PENTA-treated poles were coming along.

Steve said the specifications were in the works but he wanted to know two things—why should we change at all, and why the hurry.

That was my opening. I told him about PENTA's proven long life, the better public relations, the no extra cost, the ready availability and all the other improvements. And I pointed out that most joint-use poles were PENTA-treated and that utilities installed nearly 1½ million PENTA-treated poles last year. Then Steve broke in. He said he knew all that, but why was I so enthused about PENTA as a wood preservative.

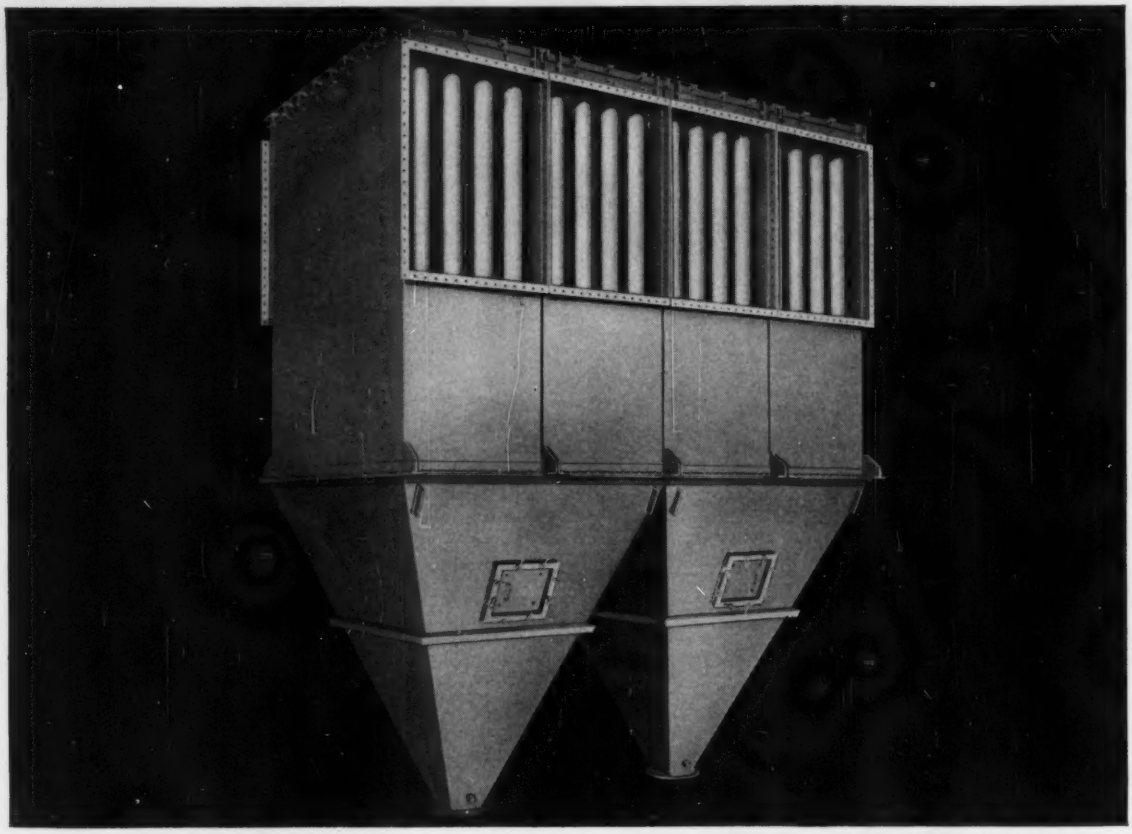
So I confessed that it was really the men in the line crews I was thinking about. They want PENTA-treated poles now, because they are much cleaner and easier to handle. Well, we're getting the specs all right and we'll be using PENTA-treated poles in our new line.

THE DOW CHEMICAL COMPANY, Midland, Michigan, Department PE 984A.

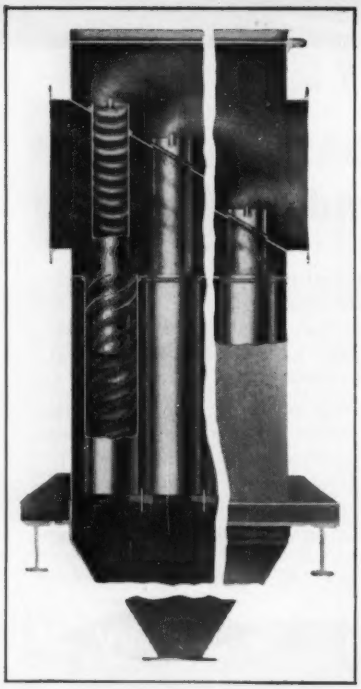
you can depend on DOW CHEMICALS

DOW

Control fly ash with job-fitted



Series 342 Precipitator



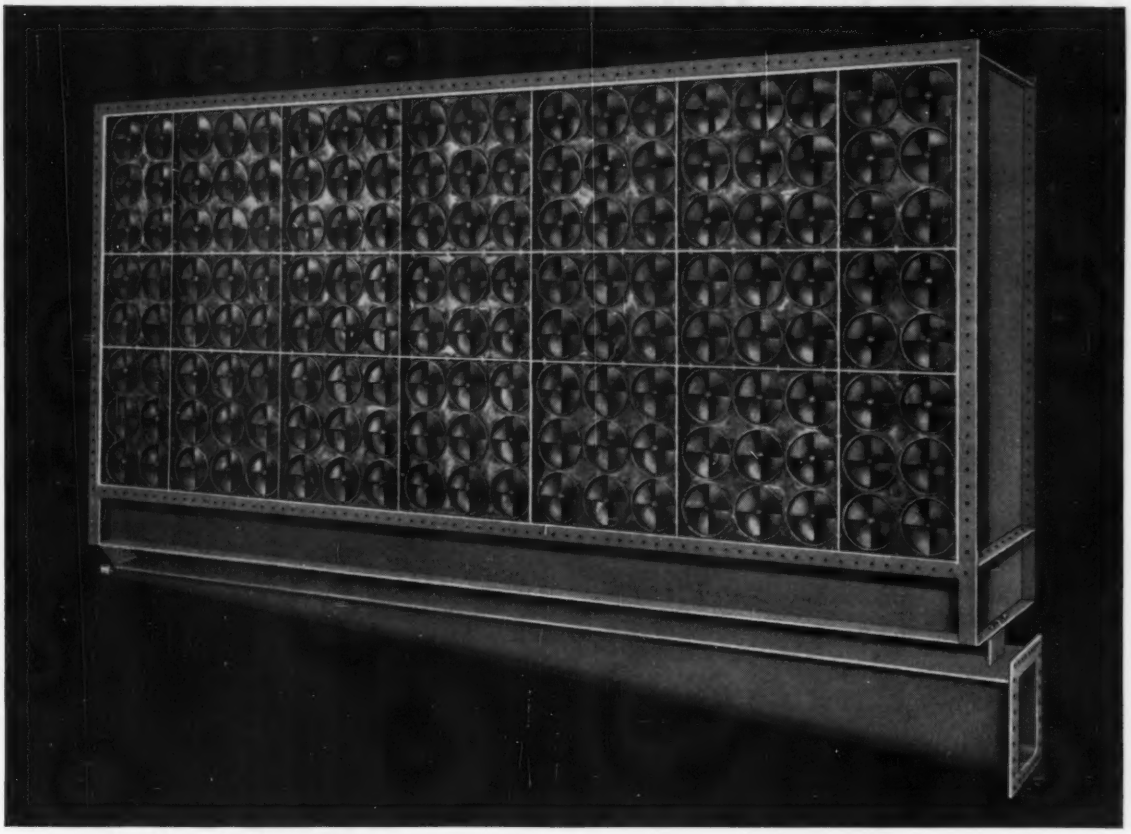
COMPACT DUST COLLECTOR – Series 342 Precipitator meets industry's need for a simple, compact, economical, all-purpose, mechanical-type dust collector. With the growing value of fly ash as a salable by-product, adequate, efficient collection is becoming increasingly important.

Easy to install because of its sectionalized construction, the Series 342 Precipitator has proved effective in controlling dust discharge to the atmosphere in a large percentage of industrial plants. The reason: since each tube assembly is basically an individual cyclone or centrifugal dust collector, the multi-tube Series 342 will deliver an over-all performance comparable to the high efficiency obtained by a single, small-diameter cyclone.

Furthermore, American Blower Series 342 Precipitator features welded-steel construction and removable tubes, is available in a variety of sizes to meet specific job requirements on either new or existing installations.

Dust-laden air or gas enters inlet plenum; gravity and centrifugal action force dust downward, adjacent to tube wall; dust is skimmed into gas-tight receptacle; cleaned air or gas moves upward through outlet tubes to outlet plenum.

American Blower precipitators

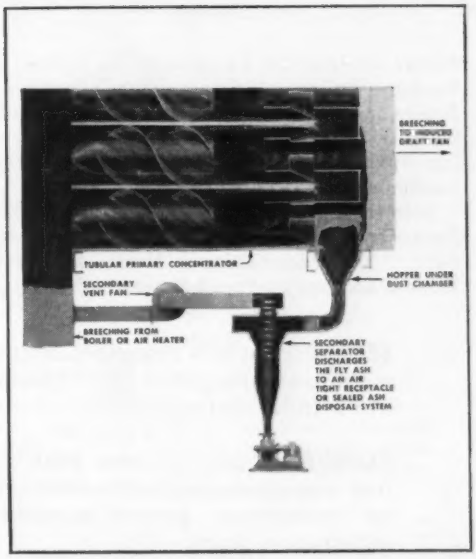


Series 361 Fly Ash Precipitator

FOR LARGE PUBLIC UTILITIES – Series 361 Fly Ash Precipitator offers maximum collection efficiency over entire operating range, occupies minimum space, and gives reliable performance, trouble-free operation.

What's more, the secondary separating system of the Series 361 makes it relatively more efficient at reduced loads when fly ash is finer and more difficult to remove. Then, too, ability to vary number and arrangement of individual cells makes it easy to tailor unit to the particular job.

Whatever your dust-collection problem, it will pay you to talk to an American Blower engineer. His knowledge of the application of precipitators and dust collectors can prove invaluable to you. Call your nearest branch, or write: American Blower Corporation, Detroit 32, Michigan. In Canada: Canadian Sirocco products.


BREECHING TO INDUCED DRAFT FAN
TUBULAR PRIMARY CONCENTRATOR
SECONDARY VENT FAN
HOPPER UNDER DUST CHAMBER
BREECHING FROM BOILER OR AIR HEATER
SECONDARY SEPARATOR DISCHARGES THE FLY ASH TO AN AIR TIGHT RECEPTACLE OR SEALED ASH DISPOSAL SYSTEM

Secondary system results in velocity-efficiency characteristics which automatically maintain maximum efficiency over entire boiler load or operating range. Properly installed and operated, unit's collection efficiency is from 85% to 90%.

AMERICAN BLOWER

Division of AMERICAN-Standard

STOP

LOOK, SEE, COMPARE at the

22nd NATIONAL EXPOSITION of POWER & MECHANICAL ENGINEERING

Under auspices of ASME

NOV. 26-30, 1956

At New York's *new* COLISEUM,

only 4 minutes from Times Square

LOOK and you will see hundreds of exhibits representing every branch of the power field, including —such products as

Power Generation Equipment • Package Boilers • Combustion Equipment • Car Shake-outs • Pumps • Compressors • Power Piping • Valves & Fittings • Boiler & Condenser Tubes • Heat Exchangers • Refractories • Water Treatment Equipment • Insulation • Oil Purifiers • Steam Specialties • Heat Transfer Equipment • Fans & Blowers • Dust Collectors • Instruments & Controls • Heating Equipment • Material Handling Equipment • Electric Motors & Controls • Metals • Packing & Gaskets • Speed Reducers • Bearings, Belting, Lubrication, Gears • Tools • Hydraulic Equipment and the fast growing list of Atomic Products

SEE and learn how new ideas, techniques and equipment open new power horizons—including progress in the industrial applications of atomic energy.

COMPARE today's power achievements—discover new ways to easier plant maintenance... faster, better production...greater economies. *For advance registration, write:*

3508

22nd NATIONAL EXPOSITION of POWER & MECHANICAL ENGINEERING

480 Lexington Ave., New York 17, N. Y.

Management: INTERNATIONAL EXPOSITION COMPANY

CATALOGS—BULLETINS

• **MISCELLANEOUS:** The publications listed below were issued recently by General Electric Co, Schenectady 5, N. Y.:

Joint Industry Conference standards are covered in GEA-6317 with reference to application features of GE control devices.

Plant recovery methods discussed in "When Disaster Strikes", GEA-6484.

Motor selection—the right motor for the right job—is the subject of "How to Choose Your Motor," GED-2020B.

Automatic Dispatching System is discussed in bulletin GER-1048 by engineers of Kansas City Power & Light Co as it has been used in their Hawthorne Station.

Static Switching Systems is covered in GEA-6364.

Phano-chargers is the concern of a 4-page publication designated GEA-3179D. It cites operation and customer benefits.

Magnetic starter modification kits for special conditions are illustrated in GEA-6481.

Fan motors for air conditioners, their construction features and other characteristics are covered in GEA-6533.

Metallic rectifier battery chargers are covered by Bulletin GEA 6525.

Gear motors are the subject of 8-page bulletin numbered GEA-6133A.

Electrical equipment for arc furnaces are discussed in Bulletin GEA-6351.

• **TEMPERATURE INDICATORS:** Data Sheet ND42-33(1) gives information relating to L&N's portable, direct-reading thermocouple potentiometer indicators. Leeds & Northrup Co, Philadelphia 44, Pa.

• **DIESEL ENGINES:** The manufacturer's 21¼ in. bore Diesel and Duafuel engines are the subject of a 20-page bulletin published by Nordberg Mfg. Co, Milwaukee 1, Wis.

• **POLYESTER FILM:** A technical bulletin, No. 17, on adhesives for "Mylar" polyester film is available DuPont Co's industrial finishes division. Write Room 7018, DuPont Building, Wilmington 98, Del.

• **WATER GAGE:** Bulletin WG-1814 describes the Color-Port water gage manufactured by Yawnall-Waring Co, Mermaid Ave, Philadelphia 18, Pa.

• **TEMPERATURE CONTROLLERS:** A brochure, MC-139, gives specifications on a new series of bulb-and-calillary indicating temperature controllers developed by Fenwal, Inc, Ashland, Mass.

• **ANALYZERS:** A folder that discusses application of L&N Infrared equipment to monitor CO, CO_2 or CH_4 content of metallurgical atmospheres in furnaces is available from Leeds & Northrup Co, 4934 Stanton Ave, Philadelphia 44, Pa.

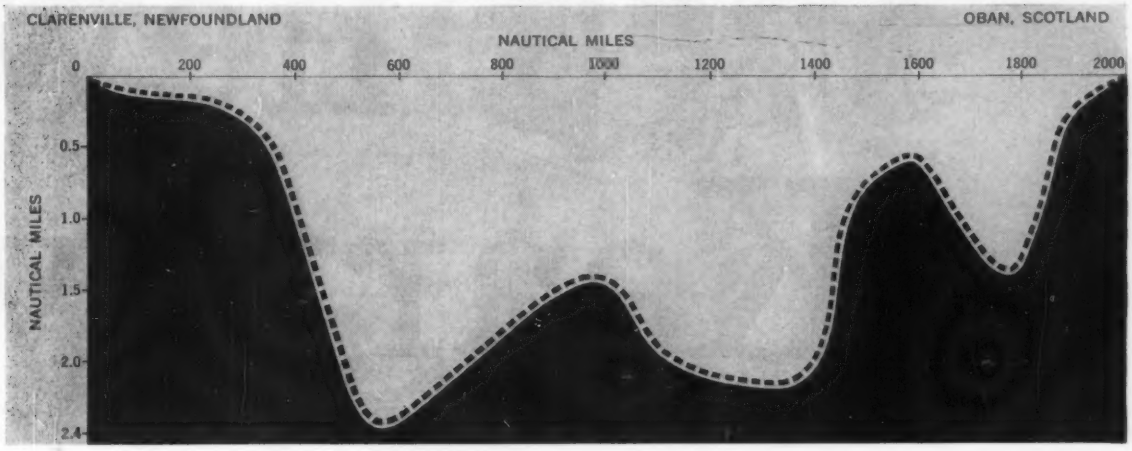
• **INDUSTRIAL X-RAY:** "Norelco X-Ray for Industry" contains operating and application data on radiography units made by North American Philips Co, Inc, 750 S. Fulton Ave, Mount Vernon, N. Y.

• **WELDING ROD:** A 4-page flyer details information, such as physical properties on the manufacturer's welding rods. Ask for Bulletin DH-1218-J from Page Steel & Wire Division, American Chain & Cable Co, Monessen, Pa.

• **MERCURY PLUNGER RELAYS:** Engineer's File Folder contains information on the maker's line of mercury plunger re-

(*Continued on page* 220)

A TRIUMPH OF TELEPHONE TECHNOLOGY



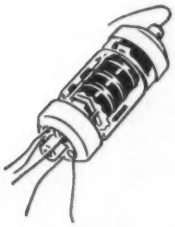
Contour of ocean bed where cable swiftly and clearly carries 36 conversations simultaneously. This is deep-sea part of system – a joint enterprise of the American Telephone and Telegraph Company, British Post Office and Canadian Overseas Telecommunications Corporation.

A great new telephone cable now links North America and Europe—the first transoceanic cable to carry voices.

To make possible this historic forward step in world communications, Bell Laboratories scientists and engineers had to solve formidable new problems never encountered with previous cables, which carry only telegraph signals.

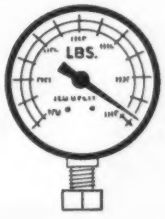
To transmit voices clearly demanded a much wider frequency band and efficient ways of overcoming huge attenuation losses over its more than 2000-mile span. The complex electronic apparatus must withstand the tremendous pressures and stresses encountered on the ocean floor, far beyond adjustment or servicing for years to come.

Here are a few of the key developments that made this unique achievement possible:

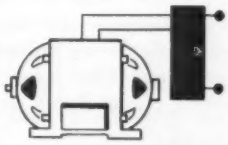


More than 300 electron tubes of unrivaled endurance operate continuously, energized by current sent from land.

Precisely designed equalizing networks and amplifiers compensate for the loss in the cable every 40 miles and produce a communication highway 144 kc. wide.



A unique triple watertight seal protects the amplifiers from pressures as high as 6500 pounds per square inch.



Power supplies of exceptional reliability send precisely regulated current along the same coaxial that carries your voice to energize the amplifying units.

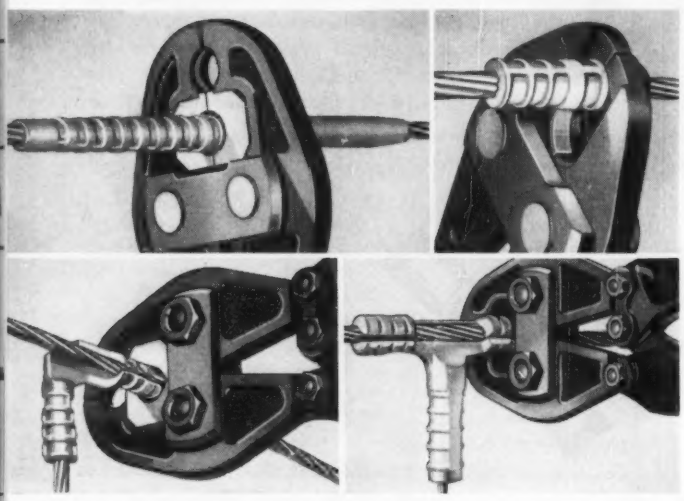
BELL TELEPHONE LABORATORIES

World center of communications research and development

SO VERSATILE . . . YOU'LL WANT

new Kearney

dies "snap in - snap out" with 2-finger ease and you get the *widest* compression fitting size range . . .



EXTRA SIZE RANGE! Fixed die in jaw nose installs Serv-Ens and L-Taps. Insert dies available to install sleeves and Squeezon fittings for most wire sizes used in distribution systems. Dies positioned close to fulcrum pins so minimum effort is needed on the tool handles. Wire cutter blades, also available, snap into same seat as the dies.

So convenient, versatile and low-cost . . . you'll want one on every line truck! Now you can make most distribution connections . . . install the *widest* range of sizes . . . with new Kearney 0-51 and 0-52 lever-action tools. "Snap in-snap out" interchangeable insert dies . . . a new Kearney *exclusive* . . . give you extra economy, speed, efficiency!

Lightweight, simple to operate . . . rugged and safe. Get yours now. Write today for Bulletin 13.

for BETTER CONSTRUCTION
SAFER MAINTENANCE

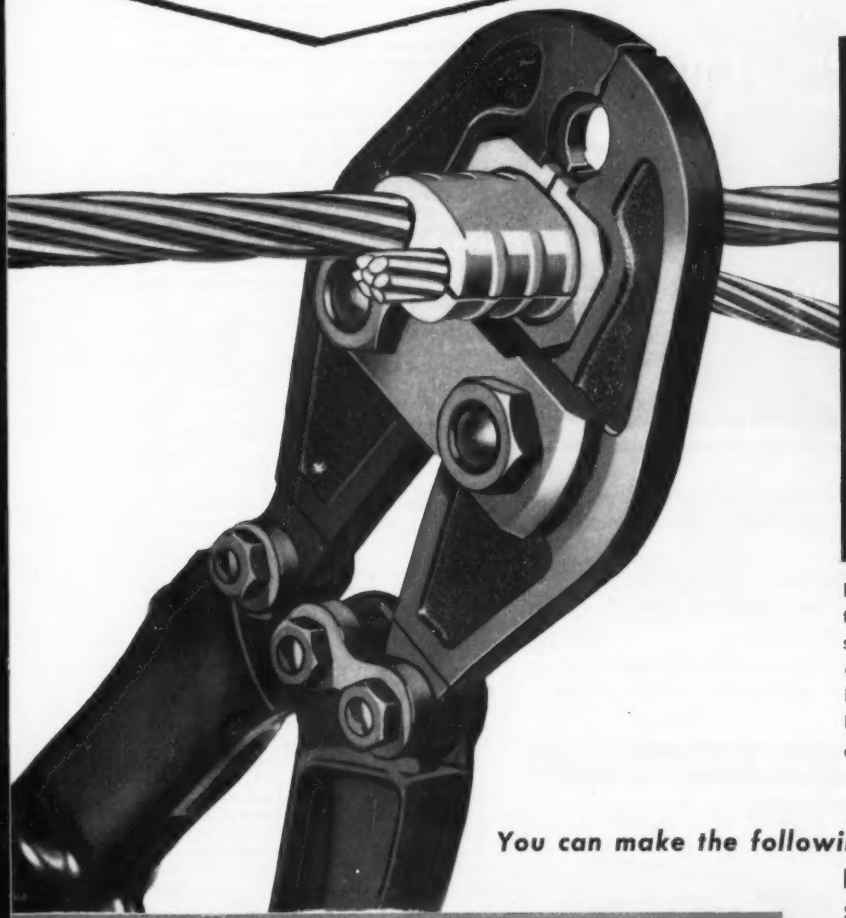
Specify JAMES R. KEARNEY CORPORATION ST. LOUIS MO. GUELPH, ONT.

The Mark of Quality

KEARNEY PRODUCTS

ONE ON EVERY LINE TRUCK!

exclusive O-51 O-52 tools



REALLY FAST, EASY DIE-CHANGING! No tools needed. Die halves are identical and self-aligning. "snap in-snap out" with 2-finger ease! Each die part locks in rectangular seat by a shoulder and groove, is held in place by spring locking pins — utmost rigidity in operation!

You can make the following connections with

KEARNEY O-51 AND O-52 TOOLS

SQUEEZONS—up to and including 4/0 ACSR, or stranded

L-TAPS—up to and including 2 ACSR, or stranded

T-TAPS—1/0 ACSR, or stranded

SERV-ENS—up to and including 1/0 ACSR, 4/0 stranded

SLEEVES—up to and including 4/0 stranded aluminum, 2/0 ACSR and stranded copper

Manufactured by

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Avenue
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Canadian Plant: GUELPH, ONTARIO

Alcoa® Aluminum meter shields protect damping magnets against damaging lightning surges that cause pre-1946 watt-hour meters to run fast.

They keep meters up to 50° F cooler, too . . . especially important with delicate demand meters. Other important benefits are physical protection and improved appearance.

Typically, it costs a utility about $5.00 to repair a demagnetized meter. With an Alcoa meter shield in action at a cost of about 50¢, that's five dollars saved.

For full information and prices, contact your nearby Alcoa sales office or write Aluminum Company of America, 2308-J Alcoa Building, Pittsburgh 19, Pennsylvania.

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ALTERNATE SUNDAY EVENINGS

Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

Catalogs—Bulletins

(*Continued from page* 216)

lays and related products. Ebert Electronics Corp, 212-31G Jamaica Ave, Queens Village 28, N. Y.

● **CIRCUIT BREAKERS:** A revised bulletin covers hydraulic-magnetic general purpose circuit breakers fabricated by Heinemann Electric Co, Plum Street, Trenton 2, N. J.

● **RESEARCH:** Facilities of the A-C Central Research Laboratories are described in a 24-page bulletin released by the company. Ask for Bulletin 48B8448 from Allis-Chalmers Mfg Co, 932 S. 70 Street, Milwaukee, Wis.

● **ELECTROPLATING:** "Industrial Precision Electroplating" is the name of a brochure describing the finishing services of the Summit Finishing Co, Thomaston, Conn.

● **SPEED REDUCERS:** A booklet entitled "Speed Reducer Engineering Manual," presents application information on the manufacturer's speed reducers. Write Westinghouse Electric Corp, P.O. Box 2099, Pittsburg 30, Pa. Ask for Booklet B-6737.

● **METERS:** An 8-page catalog describing their line of factory, field and laboratory meters has been made available by Greibach Instruments Corp, Metuchen, N. J.

● **COMPANY INFORMATION:** An 8-page brochure that provides company background, service and facilities information to contractors, architects, management and owners has been issued by National Electric Contracting Co, 296 Broadway, Passaic, N. J.

● **MICRO SWITCHES:** Data sheet 110 and Data Sheets 111 and 112 give information on Micro Switches made by Minneapolis-Honeywell Regulator Co, Freeport, Ill.

● **CLEANING:** Super cleaning of ordinary atmospheric air by means of specially adapted industrial cloth-filter-type dust collectors is treated in a new bulletin published by Wheelabrator Corp, 1748 S. Byrkit St, Mishawaka, Ind.

● **LIGHTS:** A catalog marking their 50th anniversary and covering their line of flash lights, lanterns, safety lights, carbide lamps and safety cans may be obtained from the Justrite Mfg Co, Department 66, Chicago 14, Ill.

● **MOLYBDENUM:** "A Guide to Sources and Applications of Molybdenum Chemicals," a 4-page bulletin, presents information helpful to industrial users in selecting the most economical and convenient starting materials for current molybdenum applications, including catalysts, fertilizers, pigments, lubricant additives, metal treating compounds, ceramic frits and colors, and analytical reagents. Ask for Bulletin Ch-27, Climax Molybdenum Co, Department L, 500 Fifth Ave, New York 36, N. Y.

● **HYDRAULIC FAN DRIVES:** A 6-page illustrated bulletin, numbered 3009, describes the manufacturer's hydraulic fan-drive for air-cooled heat exchangers and cooling towers. Performance curves useful in choosing the right unit for a specific application are included. De Laval Steam Turbine Co, Trenton, N. J.

• **MICA PRODUCTS:** A completely revised Engineering Data File, containing technical information, design considerations and suggested applications of the company's ceramoplastic and glass-bond mica products has been issued by the Mycalex Corp of America, 125 Clifton Blvd, Clifton, N. J.

• **PUMP TROUBLES:** A booklet, designated Bulletin PC-508 P, to help locate and correct common troubles of rotary, centrifugal, and steam pumps has been released by Worthington Corp, Merchandising Sales Department, Harrison, N. J.

• **MOTORS:** A booklet describing a new line of industrial fractional hp motors, from 1/20 to 1 hp has been published by Century Electric Co, 1806 Pine Street, St. Louis 3, Mo.

• **RESISTORS:** Three bulletins give comprehensive data on construction, types, applications, dimensions, performance, tolerance, etc., of various types of resistors. No. B-4 covers, deposited carbon resistors, No. B-8 is for molded boron carbon resistors, and No. B-9 concerns itself with molded deposited carbon resistors. Address your request to International Resistance Co, 401 N. Broad Street, Philadelphia, Pa.

• **INTERIOR LIGHTING:** a 48-page booklet, "Footcandle Levels and Interior Lighting Design Data", is designed as a reference for architects, engineers, and designers of interior lighting installations. Ask for Manual A-4854 from Westinghouse Lamp Division, Bloomfield, N. J.

• **HYPOTS:** A bulletin describing a new line of portable and bench-type HYpot electrical testing instruments is available from Associated Research, Inc, 3760 W. Belmont Ave, Chicago 18, Ill.

• **MOTORS:** Torque motors, special motors and collector rings for completing electric circuits between stationary and rotating parts are covered in a 8-page bulletin issued by B. A. Wesche Electric Co, 1623 Vine Street, Cincinnati 10, Ohio.

• **SUPPORTS:** Aluminum supports for traffic control signals and signs are covered in Catalog No. TE-1 issued by Pfaff & Kendall, 84 Foundry Street, Newark 5, N. J.

• **CONTROLS:** A 4-page bulletin on the company's Unitized Autronic Controls may be obtained on request to Swarthout Co, 18511 Euclid Ave, Cleveland 12, Ohio.

• **LIGHTING EQUIPMENT:** Form 1082 is a brochure illustrating and describing the manufacturer's line of lighting equipment. Write to the Steber Mfg Co, Broadview, Ill.

• **ELECTRICAL SPECIALTIES:** A 72-page catalog illustrating electrical wiring devices, lamps and specialty products has been issued by Eagle Electric Mfg Co, Inc, 23-10 Bridge Plaza South, Long Island City 1, N. Y.

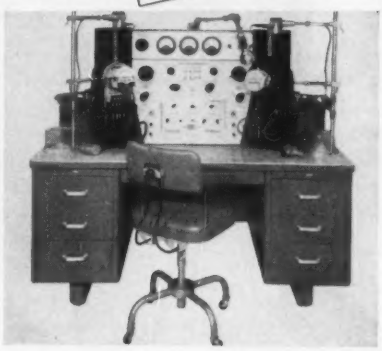
• **INDUCTION MOTORS:** Repulsion-induction (buried bar) motors are described in Engineering Data Bulletin SDA-163-A issued by Peerless Electric Co, Market Street, Warren, Ohio.

• **STOKERS:** A catalog describing the operation of the manufacturer's stokers has been published by Johnston & Jennings Co, 6917 Bessemer Ave, Cleveland 27, Ohio. Ask for Bulletin No. 562.

(*More Catalogs on page* 224)

NOW!

LIGHT—FULL LOAD TESTS AT SAME TIME ON ONE TABLE



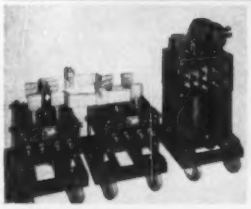
WITH

STATES

New 100 ampere capacity, high output Form "FRSDK" Test Table

Form "FRSDK" with its 100 ampere capacity assures extremely high meter test output. It allows a light load and full load test to be carried on simultaneously—by one operator . . . *light load on one meter by photoelectric method while full load on the other meter is being adjusted under the strobo beam.* Immediately upon completion of these checks, a single transfer switch shifts the controls to the opposite meter position. Thereupon, the meter having just received the light load test is checked stroboscopically for full load—and vice versa. It's another advance in rapid meter testing by STATES, leaders in electrical testing equipment.

OTHER TEST TABLES FROM THE VERSATILE STATES LINE:



FORM "CTT"
Current Transformer Loading Outfit supplied in capacities of 800 to 12,000 amperes.

FORM "FHAPBL"
Test Table for testing single phase and polyphase watthour meters.

FORM "FRS"
Single Position Watthour Meter Table with photoelectric control.

TEST WITH THE BEST . . . TEST WITH STATES!

THE STATES COMPANY

19 New Park Avenue, Hartford, Connecticut

THE STATES COMPANY

Please send me further information on TEST TABLES. Cat. 1 Sec. 3G.

Name .....Title .....

Company .....

Street Address .....

City .....Zone.....State.....

John Harrell, Manager Voltage Regulator Sales, points out that URL-16 feeder regulator with new CVR relay and instant-response Geneva gear tap changer combine to offer superior regulation with less maintenance.

Westinghouse 16-step regulation means you carry greatest load, produce most revenue

URL-16 with new CVR relay performs three exclusive functions:

1. FASTER CORRECTION OUTSIDE SET BANDWIDTH

The new CVR relay designed with inverse time characteristics actually evaluates the need for speed of response . . . steep voltage variations are corrected more quickly than gradual voltage changes. Result —a narrower effective bandwidth.

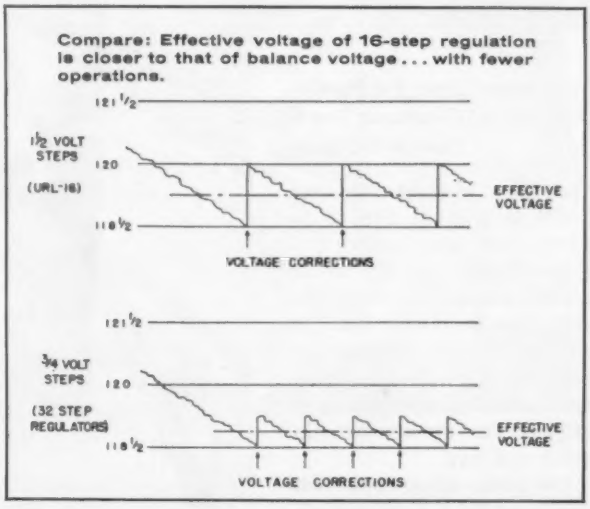
2. INSTANT-RESPONSE TAP CHANGING

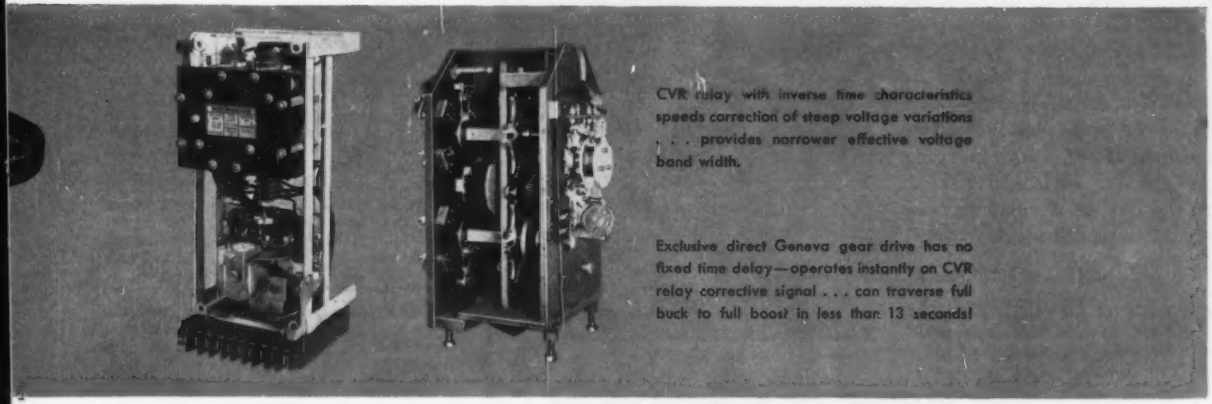
Because of direct Geneva gear drive there is no fixed time delay between relay and tap-changer operation. Tap changer operates instantly . . . can traverse full buck to full boost in less than 13 seconds!

3. 16-STEP REGULATION

The exclusive URL-16 with 1½-volt steps corrects exactly to balance voltage on a 3-volt bandwidth bringing the effective voltage nearer to this level. Similarly, the higher correction on 2-volt or greater bandwidth results in effective voltage closer to the desired level. URL-16 slashes number of corrective operations by 42%, contacts erosion 15%. Result—substantial savings in maintenance.

A narrower effective bandwidth means you can put more load on your system . . . get more revenue for power delivered. Specify new Westinghouse URL-16 regulators on your system. J-70779-X





CVR relay with inverse time characteristics speeds correction of steep voltage variations . . . provides narrower effective voltage band width.

Exclusive direct Geneva gear drive has no fixed time delay—operates instantly on CVR relay corrective signal . . . can traverse full buck to full boost in less than 13 seconds!

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***

OKLAHOMA GAS & ELECTRIC CO. SERVES

"WIDE OPEN SPACES" with TEL-E-LECT EQUIPPED UTILITY TRUCKS

. . . a report from the Norman District of Oklahoma Gas & Electric Company

"It's a sizable distance between some towns in this part of the country, but with modern Tel-E-Lect equipment our trucks can drive to location, dig a hole and move on to the next job fast. And, look at the king-sized bite this rig makes—up to a twenty inch hole down to a depth of 8 feet. That's pole hole diggin' quick and easy!

Our trucks are equipped with two-speed Tel-E-Lect transmissions—a slow speed for powerful digging and a high speed gear for rapid rotation to spin loose dirt off the auger. These Tel-E-Lect rigs do all kinds of pole line work and much more. For example, after finishing up a pole job one day we loaned a truck to the city of Norman to bore holes for planting evergreens."

Paul Benge, of the Oklahoma Gas & Electric Co., measures the diameter of a hole dug with a Tel-E-Lect digger.

For complete information on pole hole digging equipment, mechanical and hydraulically operated derricks, digger drive systems and custom utility bodies write:

TEL-E-LECT

10003 Minnetonka Blvd.
Minneapolis 26, Minnesota
PRODUCTS, INC.

Catalogs—Bulletins

(*Continued from page* 221)

● **FUSE CUTOUT:** Bulletin P-756 covers the company's new fuse cutout. Write Hubbard & Co, Pittsburgh 1, Pa.

● **TERMINAL BLOCKS:** Catalog No. 556, describing the manufacturer's line of terminal blocks and terminal block kits has been published by Curtis Development & Mfg Co, 3250 N. 33rd Street, Milwaukee 16, Wis.

● **ANNUCIATORS:** A 32-page catalog, No. 100B, gives information on the line of standard, integrated Panalarm Annuciator systems for industry made by Panalarm Division, Panellit, Inc, 7401 N. Hamlin Ave, Skokie, Ill.

● **PORCELAIN INSULATORS:** A new, extensive catalog details engineering data for Victor's purified porcelain insulators. It covers the latest EEI and NEMA standards. Sections of the book include: An illustrated story of the Victor's plant, research facilities, quality control systems and manufacturing methods; information on the lines of pintypes, guy strains, spools, line posts, suspensions, switch and bus insulators, malleable, forged teel and aluminum hardware and indoor BIL indoor switch and bus supports. Ask for Catalog No. 56 from Victor Insulator Division, I-T-E Circuit Breaker Co, Inc, Victor, N. Y.

● **WIRING DEVICES:** "Wiring Device Catalog No. 29" is the name of a recent publication listing and describes the complete line of wiring devices and enclosed switches manufactured by the Arrow-Hart & Hegeman Co, Hartford, Conn.

● **PIPE INSULATION:** A reference guide for specifying proper thickness for pipe insulation, which gives physical and thermal characteristics has been published by Union Asbestos & Rubber Co, 1111 W. Perry Street, Bloomington, Ill.

● **CHEMICAL PROCESS EQUIPMENT:** A brochure is now available from L & N which presents all their instruments for chemical process applications, including changes in temperature, pH, gas concentrations and other operating variables. Write Leeds & Northrup Co, 4907 Stenton Ave, Philadelphia 44, Pa.

● **LOAD CLAMP:** A 4-page folder illustrating and describing its Cascade load clamp, side shift and rotating attachments has been released by Elwell-Parker Electric Co, 4205 St. Clair Ave, Cleveland 3, Ohio.

● **REACTORS:** Competitive power from the atom and the capabilities of ALCO products to supply reactor power plants are covered in a bulletin by ALCO Products, Inc, Box 1065, Schenectady 5, N. Y.

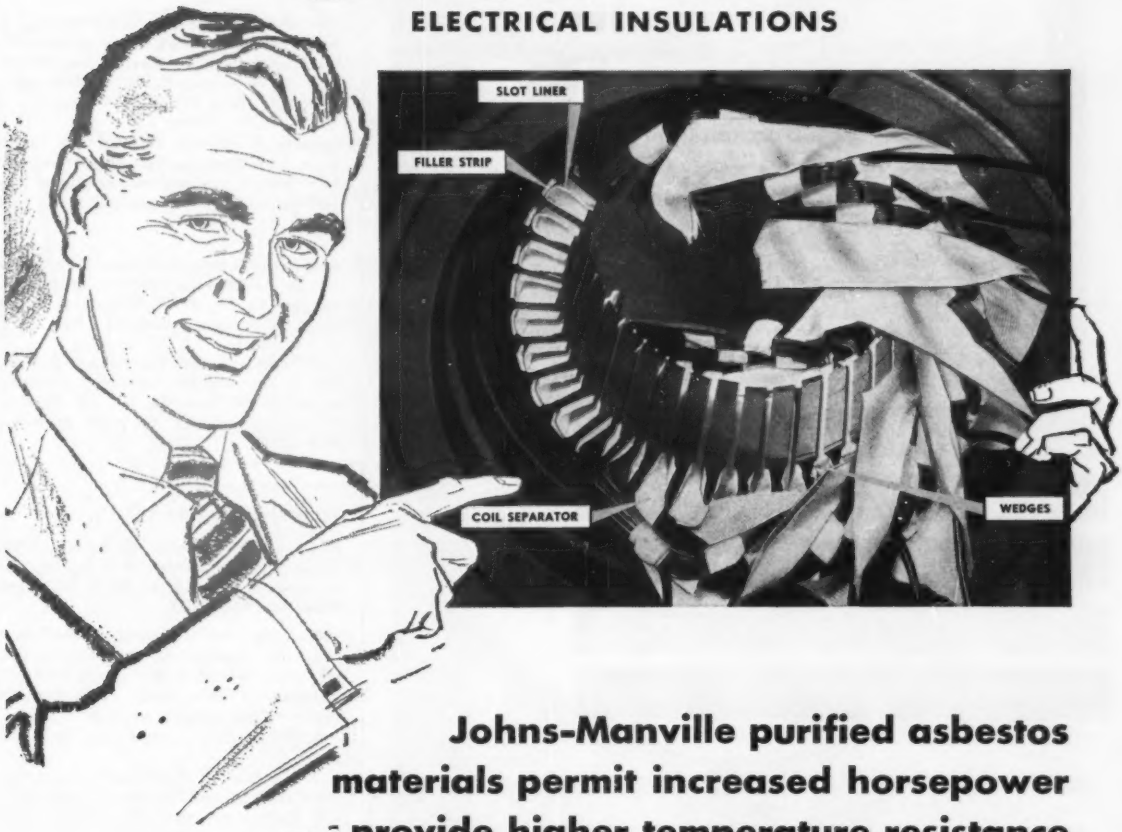
● **SOCKETS:** Bulletin 56-A describes the line of 4, 5, and 6-terminal general purpose sockets for 100, 150 and 200-amp ratings fabricated by Anchor Mfg Co, Manchester, N. H.

● **INDUSTRY SERVICE:** A booklet, entitled "Serving Industry—The Story of H. K. Porter Co, Inc," describes a previously issued film of the same title and subject. A description of the company, its plants and services are given. Address H. K. Porter Co, ALCOA Building, Pittsburg, Pa.

Smaller motors carry bigger loads when you insulate with

Quinterra®

ELECTRICAL INSULATIONS



Johns-Manville purified asbestos materials permit increased horsepower . . . provide higher temperature resistance

MOTORS insulated with Quinterra will outperform others of substantially higher rating but with less heat-resistant insulation.

The above photograph shows how you can use *Quinterra* and its companion product *Quinterrabord*® on a standard Class H induction motor. *Quinterra* Type 3-GR was employed for slot liners and coil separators. Wedges and filler strips are of *Quinterrabord* Type 3. Both materials are made from highly purified asbestos fibres treated with silicone resin for the highest combination of dielectric strength and pyrolysis resistance obtainable. In addition, Type 3-GR is reinforced with a strengthening layer of fine glass cloth.

Johns-Manville has developed a complete line of *Quinterra* materials for application in motors, transformers and other electrical apparatus. For further information write for brochure EL-40A. Address Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville ELECTRICAL INSULATIONS

It's a good idea to call

FLINT

The integrity of an organization is best evidenced by the qualifications of the men who represent it and their ability to serve their customers.

FABRICATED STEEL PLATE

STEEL WAREHOUSE DISTRIBUTORS

FABRICATED GALVANIZED STEEL

FABRICATED STRUCTURAL STEEL

FABRICATED REINFORCING STEEL

CONCRETE REINFORCING STEEL INSTITUTE C.R.S.I. FOUNDED 1924

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for over 40 years

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TULSA . . . MEMPHIS

BOOKS

Received Since Sept. 5

The Art and Science of Protective Relaying. By C. Russell Mason. Published by John Wiley & Sons, Inc., 440 Fourth Ave, New York 16, N. Y. 410 pages, illustrated. Price $12.00.

Basic Electrical Principles. By Maurice Grayle Suffern. Published by McGraw-Hill Book Co, Inc, 330 W. 42nd St, New York 36, N. Y. 454 pages, illustrated. Price $4.00.

Air Pollution Handbook. Edited by Paul L. Magill, Francis R. Holden, Charles Ackley. Published by McGraw-Hill Book Co, Inc, 330 W. 42nd St, New York 36, N. Y. 670 pages, illustrated. Price $15.00.

Currents, Fields, and Particles. By Francis Bitter. Published by Technology Press and John Wiley & Son, Inc, 440 Fourth Ave, New York 16, N. Y. 599 pages, illustrated. Price $8.50.

Basic Electricity-Laboratory Manual. By B. Zbar and Sid Schildkraut. Published by McGraw-Hill Book Co, Inc, 300 W. 42nd St, New York 36, N. Y. 91 pages, illustrated. Price $1.75.

Basic Radio and Radio-Receiver Servicing. By Paul B. Zbar and Sid Schildkraut. Published by McGraw-Hill Book Co, Inc, 330 W. 42nd St, New York 36, N. Y. 105 pages, illustrated. Price $2.00.

What Is Engineering?

Engineering As A Career. By Ralph J. Smith. Published by McGraw-Hill Book Co, Inc, 330 W. 42nd St., New York 36, N. Y. 372 pages, illustrated. Price $4.75.

Guiding the engineering freshman into the branch of engineering for which he is best suited is the primary purpose of this book. Presentation stresses six objectives, viz:

1. Presenting engineering as a career;
2. Explaining the qualifications, duties, and responsibilities of engineers;
3. Defining the functions and branches of engineering;
4. Motivating the study of pre-engineering courses;
5. Introducing the philosophy and technique of solving engineering problems;
6. Previewing basic engineering science and its application.

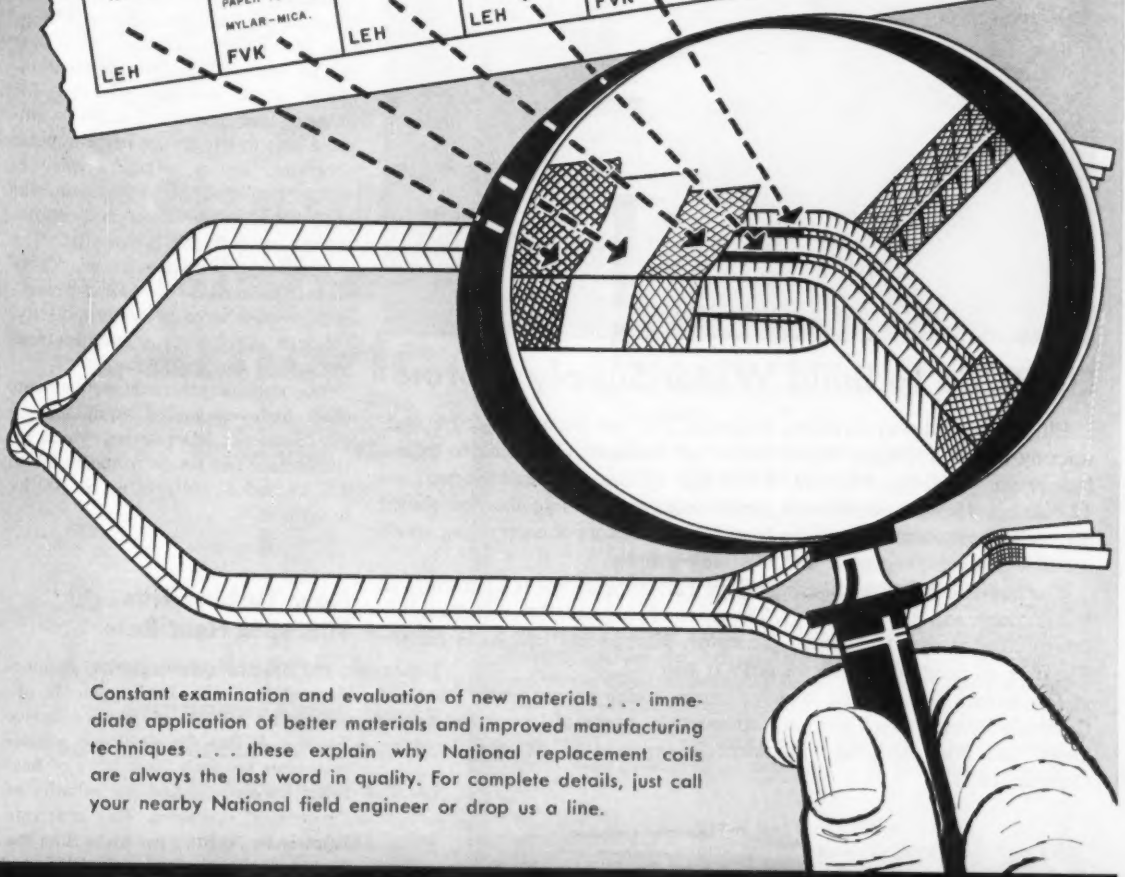
Built upon 10 years of freshman orientation and many lectures, the book is admirably suited to its intended use as an introductory text.

But engineers called upon to combat today's shortage of engineers by counselling high school students can get valuable assistance from this orientation text. Written for boys only a year or two older than their school audiences, it illustrates types of information and methods of presentation which are most likely to hold their interest.

CONTINUAL IMPROVEMENT MAKES *NATIONAL REPLACEMENT COILS* THE LAST WORD IN QUALITY

REVISIONS				
4-20-56 CHANGED VARNISH FROM 2A120 TO-2A220. LEH	6-23-55 CHANGED WRAPPER FROM .007" MICA ROPE PAPER TO .008" MYLAR-MICA. FVK	4-12-55 CHANGED FROM 8A48 MICA TAPE TO SIL. BOND 8A96. LEH	8-16-54 CHANGED FROM S. PAPER STIFFENERS TO S. GLASS. LEH	5-22-56 CHANGED FROM DFG WIRE TO SILICONE DOUBLE DACRON GLASS. FVK

Core Data Furnished By: FVK 3/25/52
SHEET: / OF /
NATIONAL ELECTRIC COIL COMPANY
COLUMBUS, OHIO — BLUEFIELD, W. VA.
Drawn by FVK — Approved PCH 3/27/52
Traced by LW — Date 3/25/52
DWG. NO. 101 - 496

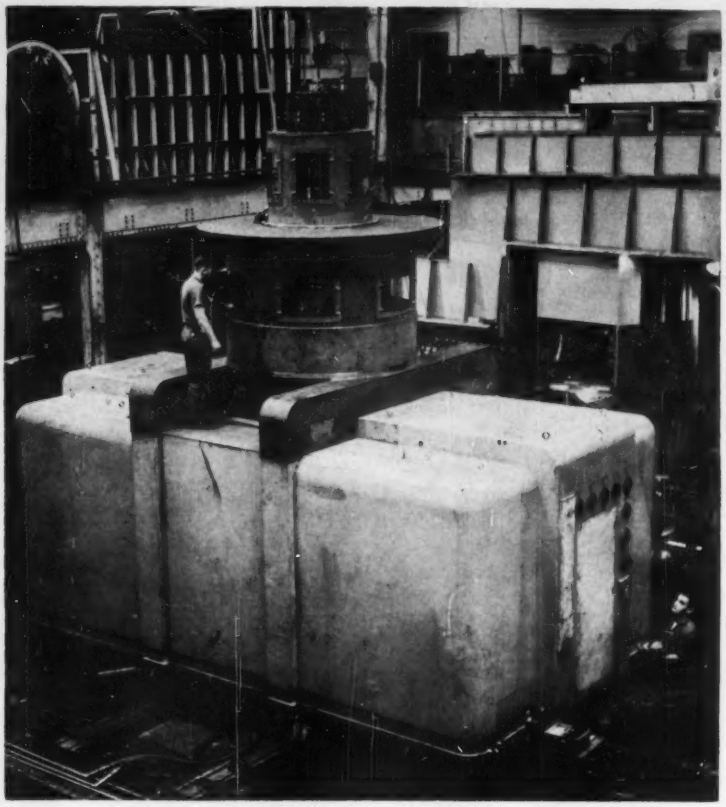


Constant examination and evaluation of new materials . . . immediate application of better materials and improved manufacturing techniques . . . these explain why National replacement coils are always the last word in quality. For complete details, just call your nearby National field engineer or drop us a line.

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION—REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES



Elliott Co to Build Water-Supply Motors

Elliott Co, Ridgway Division, Ridgway, Pa., has been awarded a contract by the Metropolitan Water District of Southern California to manufacture six 9,000-hp, 400-rpm, 6,900-volt synchronous motors, and six 12,500 hp, 450-rpm, 6,900-volt synchronous motors like the one shown above. These motors will exactly duplicate two motors of each rating which are now nearing completion for the same customer.

The box-like air cooler housing on the 12,500-hp motor is 21 ft long, 12 ft 2 in. deep, and 8 ft 10 in. high. The assembly atop the housing (from top down) consists of a tachometer generator, pilot exciter and main exciter. The over-all height of the motor is 19 ft 4 in.

The motors will be used to drive pumps which supply water from the Colorado River across California, to meet the needs of Los Angeles, San Diego and other localities. Shipment is expected to be completed by October, 1958.

G & W Designs 3/C Pothead for 34-kv Pipe-Type Cable

Potheads for 200 psi oil or gas-filled pipe-type cable have been developed in three-conductor style for generator cable terminations. A 34.5-kv unit has been produced by G&W Electric Specialty Co, Chicago, Ill., for an eastern utility.

A design feature is the spreader-head body made of welded non-magnetic stainless steel. No castings are reported used in contact with the high pressure oil or gas. Pipe size is 6 in. ID.

Simplex W & C Installs New Impulse Generator

Simplex Wire & Cable Co, Cambridge, Mass., has completed installation tests on the first Philips high-voltage generator in the United States. The unit is now in operation in the Simplex high-voltage laboratory at Cambridge.

This generator is rated at 1,400,000 volts with an energy of 16-kw-sec. It will be used in the evaluation of high-voltage cables and associated materials, and forms one part of a development program which Simplex is undertaking. It was manufactured by the Philips Co, Eindhoven, Netherlands, and was purchased through the North American Philips Co, Mt. Vernon, N. Y.

The unit's auxiliary equipment includes a dc selenium rectifier for charging the generator, a 50-kv impulse unit to trigger the main impulse generator, and a voltage divider to which oscillographic equipment for both visual observation and photographic recording is connected. The circuit is primarily designed to give an AIEE standard 1.5/40 microsecond impulse wave of either polarity, although other wave shapes for special testing can be obtained.

The impulse generator supplements other high-voltage test equipment in the company's laboratories, which includes facilities for ac voltages up to 750 kv and dc voltages up to 500 kv to ground.

New Turbine Hits 9090 Btu Heat Rate

A 200-Mw Westinghouse turbine-generator in the Burlington, N. J., generating station of Public Service Electric & Gas Co produced a kilowatt-hour for each 9090 Btu's of heat input during the first six months of "in-service" operation. This heat rate is lower by 20 Btu's per kwhr than the best station in the nation in 1955, according to recently released Federal Power Commission figures. (EW, Sept. 24, p. 10).

Steam conditions for this turbine-generator are: 2,350 psig, 1,100/

(*Continued on page* 230)

One of the large wrapping machines which applies varnished cambric tapes to various types of Rockbestos A.V.C. cables. Rotating heads apply the specially selected tapes to provide specified mil wall thicknesses, desired lap and length of lay required by the type of cable in process.
Pictured is the application of fluffy asbestos prior to the impregnating and compressing process.
Impregnated asbestos compressed and felted to a smooth homogeneous wall ensuring long cable life.

Quality Varnished Cambric Tapes

+

felted asbestos walls impregnated with selected compounds add up to long life Rockbestos A.V.C. (N.E.C. Type AVA)

Made to Rockbestos' exacting specifications which incorporate standards beyond those called for by industry, Rockbestos varnished cambric tapes assure you of these plus values:

- ★ **A special surface treatment which insures that the tape will wrap properly, providing uniform dielectric strength and good bending characteristics in the completed cable.**
- ★ **Special surface hardness tests which mean varnish film that will not become damaged in processing or handling.**
- ★ **Rigid tape thickness requirements which give you uniformity of cable diameters.**
- ★ **Add to this thirty years of know-how in the application of VC tapes for high temperature application on Rockbestos A.V.C. cables and you have A.V.C. cable that insures trouble-free operation and long life.**

In the Rockbestos A.V.C. construction dense, felted asbestos walls, impregnated with selected compounds, seal the quality VC tapes away from air and moisture . . . give added strength against damage and flexing.

The result . . . you get long life and dependable service under every type of operating condition . . . in temperatures up to 230°F.

Complete construction and test specifications of Rockbestos A.V.C. are in the new booklet "Specifications RSS-88." Write today for your Free copy.

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STOCKED COAST TO COAST
Standard Rockbestos A.V.C. construction (N.E.C. types AVA, AVB, etc.) are available for immediate shipment. Call or write nearest branch office.

(*Continued from page* 228)

1,050F. The turbine is a tandem-compound, triple-exhaust, 3,600-rpm machine. The generator is hydrogen cooled, with the rotor inner-cooled by hydrogen flowing through hollow field conductors.

Reynolds Considers Plant for Aluminum Reduction

Reynolds Mining Corp has exercised its option to purchase land near Lake DeSmet, Wyo., for possible construction of an aluminum reduction plant.

The corporation, a subsidiary of Reynolds Metals Co, would utilize the vast soft coal deposits in the area.

Pacific Power & Light Co and Reynolds have been working on plans for a steam generating power plant to supply power to Reynolds if it is decided to erect the plant.

New Shopping Center Gets 'High-Lighted'

Northland Shopping Center, Jennings, Mo.—one of the latest in the U. S.—displays its modern outdoor lighting system. Here 324 mercury vapor lamps mounted in Ovalite luminaires are used to provide illumination and beautification of this 40-acre, 5,000-car parking lot.

Lighting equipment includes 324 twin-mounted Ovalite luminaires with Safe-Service disconnecting sockets, produced by Line Material Co, Milwaukee 1, Wis.; Type E-H1 400-watt mercury vapor lamps, 20,000 lumens per lamp, providing 1.4 ft-candles (average) at the pavement. The lamps are operated with individual ballasts, connected in multiple on an underground circuit, and are mounted on 30-ft steel standards supplied by Union Metal Mfg Co, Canton, Ohio.

Cornell-Dubilier Acquires Stock of Tobe Deutschmann

Cornell-Dubilier Electric Corp of South Plainsfield, N. J., has acquired majority of stock in the Tobe Deutschmann Corp of Norwood, Mass., according to Octave Blake, president of Cornell-Dubilier. Both companies manufacture a wide range of capacitors as well as other electrical equipment for utility, industrial, radio and specialized use. Also cable and line fault locators are produced at Norwood.

Blake stated that Deutschmann will continue as president of the company bearing his name, and will direct the work of a large research staff for the mutual benefit of the combined firms.

Westinghouse Reports Developments

Westinghouse Electric Corp has reported these developments:

- Decentralization of its Lamp Division into five product departments in order to meet the challenge of a growing lamp market in a rapidly expanding economy.
- The completion of a microwave system for traffic control along with the new 236-mile Kansas Turnpike, opened recently.
- Receipt of a $2 million contract for the fabrication and installation of an automatic elevator system in the Tishman skyscraper in New York City.
- Recent assignment of the responsibility for the control and instrumentation of nuclear reactor plants used for generation of power and propulsion purposes to its Switchgear Division at the East Pittsburgh plant.

GE, Ltd, Builds Generator

London—(McGraw-Hill WORLD NEWS)—General Electric Co, Ltd, is to build the 15-mw steam turbo generator for Britain's first fast-breeder reactor nuclear power station under construction at Dounreay, Scotland. An experimental prototype of very advanced design, the Dounreay reactor is due to go into operation in 1958. The 3-phase, 50-cycle 11-kv generator will be designed to operate initially at 150 psig and 518 F.

RWMA Reports Business Up for 9 Months

The September statistical report of the Resistance Welder Manufacturers Association indicates a continued high level of activity through the nine months of 1956. Orders are said to be 43% ahead of the same period last year.

For the fourth consecutive month, shipments by members of the Association were in excess of $4 million. Figures at the end of the first three quarters of 1956 show a 51% gain over the same similar period a year ago.

Weston Opens Offices

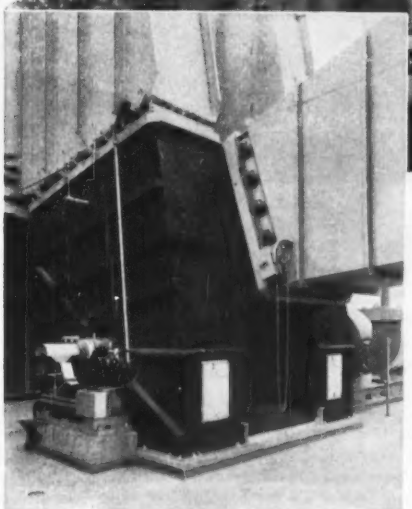
Weston Electrical Instrument Corp, Newark, N. J., has opened the following district sales offices: Los Angeles, Cal., at 2001 S. Grand Ave; Cincinnati, Ohio, at 7613 Reading Road; Philadelphia, Pa., at 101 N. 33rd Street; and Union, N. J., at Caldwell Ave and Route 22.

(*More M&M on page* 233)

THE CINCINNATI GAS & ELECTRIC COMPANY INCREASES ITS CAPACITY

— SPECIFIES "BUFFALO" INDUCED DRAFT FANS

Walter C. Beckjord Generating Station, Unit No. 3, Cincinnati Gas & Electric Company, where dependable induced draft by "Buffalo" helps supply power for this well-known utility's growing list of customers.



"Buffalo" I. D. Fan at Walter C. Beckjord Generating Station, Unit No. 3. Note heavy, reinforced construction of inlet boxes and housing. Inlet dampers provide instant, positive draft control to match load. Heavy-duty self-aligning bearings are water-cooled. Fan wheels and housings are engineered to resist effects of heat and erosion.

ADDITIONAL "BUFFALO" FANS ORDERED FOR ANOTHER UNIT TO START UP IN DECEMBER 1957

The Cincinnati Gas & Electric Company, pushing through its ambitious program of expanded service, specified "Buffalo" I. D. Fans for both this new Unit No. 3 station and Unit No. 4 which will be operating in 1957.

Selection of "Buffalo" by leading utilities for many, many years is your assurance of dependable, economical draft service. In fact, the "Buffalo" Mechanical Draft Fan you specify embodies the best of our 79 years of fanmanship — peak endurance, peak efficiency for its job — in other words, the "Q" Factor* that's built into every "Buffalo" Fan. You'll be interested in our new, improved lines of forced and induced draft fans — write for engineering data today!

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

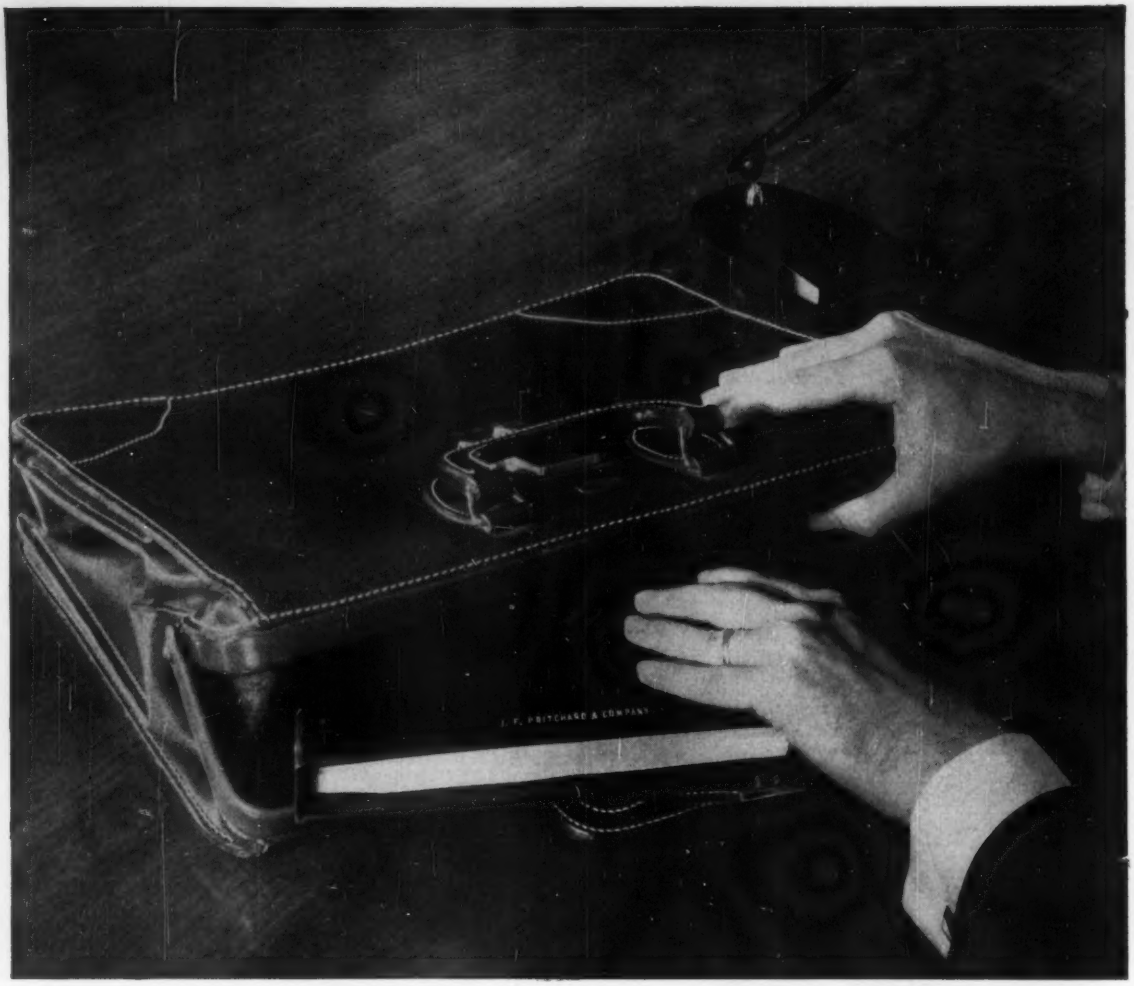
BUFFALO FORGE COMPANY

BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING



"Contract signed with Pritchard—and with complete confidence"

"I know you've been working with them on plans for the new power plant, but why are you so pleased?"

"Because this is a Pritchard Single Responsibility Contract."

"What kind of a contract is that?"

"It means that Pritchard has taken full responsibility for everything—engineering, design, drafting, purchasing and construction."

"Oh, I see! This way you are dealing with just one company and not a lot of different ones. Is that it?"

"Yes, but just part of it. With this contract, we know what the total cost of the plant is going to be before it's started. Pritchard co-ordinates all of the buying. They save us money on labor. And we get a firm guarantee of operation of the completed power plant. One more very important thing—perhaps the most important . . ."

"What's that?"

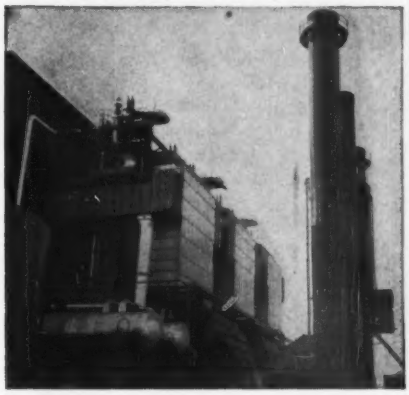
"We start getting a return on our investment faster because the construction job gets done faster."

"I can see now why you feel so good about that contract."

J. F. PRITCHARD & CO.
4625 Roanoke Parkway, Kansas City 12, Mo.

"Contract signed with Pritchard—and with complete confidence."

Three reasons why Pritchard is the choice for power plant design and construction!



Three *big reasons!*

One, Pritchard ability and experience. Unrivaled in the field. Ready to go to work for you now!

Two, Pritchard ability to work *with* your staff on every step from drawing board to completion!

Three, Pritchard's time-saving, money-saving, Single Responsibility Contract!

Three big reasons why—when you plan to build, expand or modernize—it will be wise to include Pritchard in those plans!

YOUR INQUIRY IS INVITED

If you would like more information on Pritchard's Single Responsibility Contract, simply write on your company letterhead. Of course, there is no obligation.

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BOSTON, CHICAGO, BUFFALO, HOUSTON, NEW YORK, PITTSBURGH

MANUFACTURERS' PLANT EXPANSIONS

• More than doubling the warehousing and sales office facilities it established in California five years ago, resulted when Sylvania Electric Products Inc opened recently a 87,000-sq ft distribution center at Los Angeles and another of 79,000 sq ft in the San Francisco area. Each distribution center will stock all of Sylvania's products except television sets. Each has a four-car rail spur, six-truck unloading dock, and 75-car parking area.

• A new sales office and warehouse has been opened at Newington, Conn., by Line Material Co. Field Engineer C. L. Hopkins will use the new building for his service center. Branch supervisor Archie Bowser will handle office and warehouse activities.

• Expanded facilities for production of dynamotors, generators, and electrolytic capacitors for electronic equipment was put in operation recently at Pickens, S. C., by Sangamo Electric Co. The $5 million plant has some 200,000 sq ft of floor area.

• A boost in lighting fixture output has been achieved by Thomas Industries, Inc, makers of the Moe Light line, with addition of a Ft. Atkinson, Wis., plant. It combines research and development and model-making in one area.

• Occupany of the new research and advanced engineering center of Arvin, Industries, Inc, is now nearing the 100% mark, it was reported. Located adjacent to the company's offices in Columbus, Ind., the research center was begun last winter, and gradual occupany began in June of this year.

• Expansion of manufacturing capacity for cellophane and Mylar polyester film is planned by the DuPont Company's Film Dept. New facilities to be installed at the Clinton, Iowa, cellophane plant is to provide about 10 million pounds additional by mid-1958. New construction at Circleville, Ohio, should increase Mylar productive capacity by about 50% early in 1958.

• A 65% expansion of manufacturing space for residential lighting fixtures, chimes and exhaust fans will be gained with a 235,000-sq ft, $2-million plant scheduled by Progress Mfg Co, Inc. The Philadelphia addition is on a nine-acre site.

• Electrical component production will be upped in a 40,000-sq ft Toccoa, Ga., building, one step in a $9-million expansion program underway by LeTourneau-Westinghouse Co. Other additions include a new structure in Peoria and new equipment for the Adams Division in Indianapolis.

• Complete self-sufficiency will be the result of a recently begun 90,000 sq ft expansion at the Anderson Electric Corp's Leeds, Ala., plant, according to a spokesman for the company. The addition, expected to be completed by January 1, 1957, will house the firm's aluminum products division.

• Construction of a 140,000 sq ft facility will house manufacturing, purchasing, and warehousing operations for Atomics International, a division of North American Aviation, Inc. Located at Van Nuys, Calif., the new plant will reportedly double the company's present plant area.

M & M BRIEFS

Honeywell has arranged for jeweled-tip pens to make their industrial bow. Minute, clear sapphire pen points have been incorporated into a line of strip chart recording instruments made by Minneapolis-Honeywell's Industrial Division, Philadelphia, Pa. The gems, about the size of a pin head, are rounded to prevent scuffing the paper. The gems are made synthetically and are reported superior to real gems for industrial use because they are perfect.

Marco Industries Inc of Womelsdorf, Pa., a producer of fractional-horsepower motors, reports that all of its current types of motors have received Underwriters' Laboratories approval. The motors are made for the

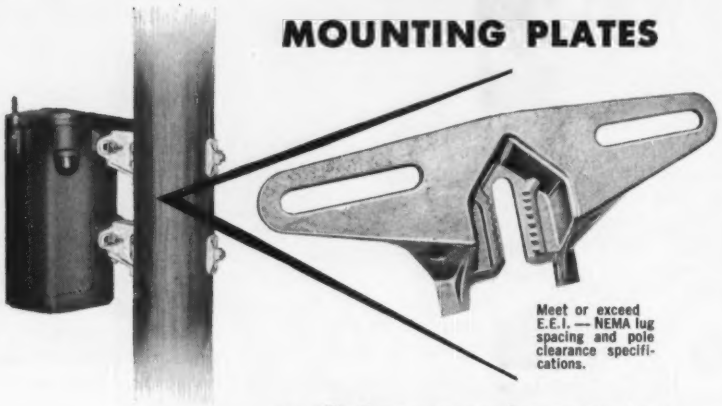
malleable iron

high corrosion resistant

Versatile

TRANSFORMER

MOUNTING PLATES



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- **Simplify conversion to thru-bolt mountings.**
- **Provide completely 'jump-proof' installations.**
- **Reduce installation costs to an absolute minimum.**
- **Adapt to wood or steel installations as well as cluster mountings.**

For further information write for Bulletin PH11-D

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Representatives: William J. Cottrell Co., Portland, Ore. • James H. Drew Corp., Indianapolis, Ind. • Industrial Engr. & Equip. Corp., Los Angeles, Cal. • JSG Electric Co., Chicago, Ill. • Lee-Smith Co., Miami, Fla. • B. H. McCoin, Knoxville, Tenn. • William J. O'Brien, Memphis, Tenn. • Robert P. Smith & Co., Jacksonville, Fla. • E. A. Thornwell, Inc., Atlanta, Ga. • J. P. Voight, Summerville, S. C. • Waltham, DeWitt & Krusi, San Francisco, Cal. • L. G. Wendegatz, Kansas City, Mo. • Williamson Sales Co., Shreveport and New Orleans, La.; Dallas, Houston, Tex.; Pine Bluff, Ark. • O. C. Witte Co., Detroit, Mich. **In Canada:** Line & Cable Accessories, Ltd., Toronto

air moving equipment industry. Sizes range from 1/100 to ¼ hp for shaded-pole motors, and from 1/100 to ⅓ hp for permanent-split capacitor motors. The company has recently marked its 10th anniversary by producing its 6 millionth motor.

Newhauser and Wrobel, manufacturers representative, has been formed by Jack K. Neuhauser and Lawrence H. Wrobel, with offices at 1330 West Washington Blvd, Chicago 7, Ill. This firm will be representing: Mitchell Lighting, a division of Compco Corp; Fasco Industries, in the fan and ventilator line; and Electromode, division of Commercial Controls Corp, in electric heating.

Harvey Aluminum, Inc, Torrance, Calif., has surrendered its preliminary permit to the Federal Power Commission for a hydroelectric project on the Copper River in Alaska.

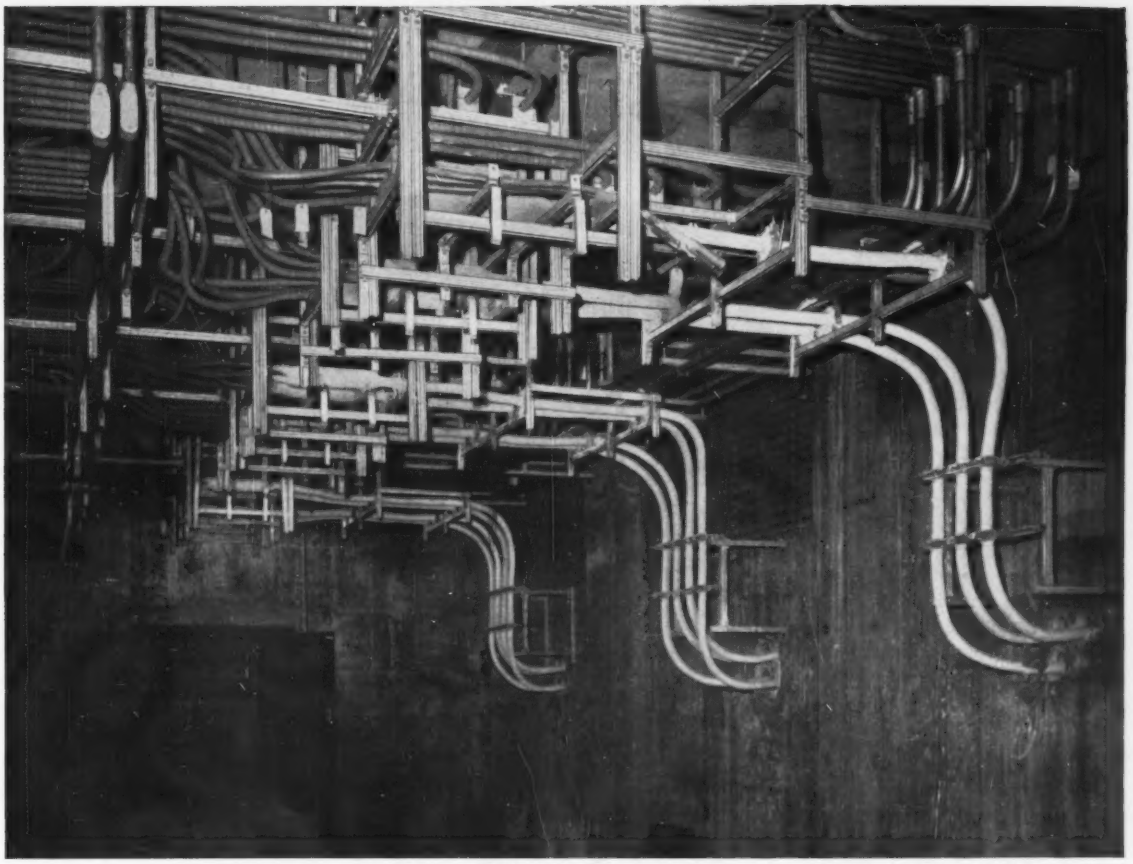
Byron Jackson Pumps, Inc, Los Angeles, Calif, is fabricating a liquid sodium primary cooling pump for Atomic Power Associates, Inc, to be used in one of the nation's first full-scale commercial nuclear power plants.

Clark Controller Co, 4755 E. 49 Street, Los Angeles 58, Calif., has established engineering and manufacturing facilities in that city to better serve its growing volume of business in the area.

Stackpole Carbon Co., St. Marys, Pa., recently celebrated its 50th Anniversary. The firm was founded in 1906 as the Stackpole Battery Co; its name was changed six years later to the present form when brushes and other graphite specialties were added to the company lines.

National Bureau of Standards, Washington 25, D. C., has determined the linear thermal expansion of annealed polytetrafluoroethylene (Teflon) from —190 to 300 C. Results of the Bureau's findings are published in Summary Technical Report 2037.

H. A. Wilson Co, manufacturers of electrical contacts, 2655 U. S. Route 22, Union, N. J., has begun publication of "The Wilco Tech Bulletin," to be distributed periodically to engineers upon written request.



High voltage cable support and conduit racking in large municipal power plant.

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Extra strong, all-steel UNISTRUT adjustable framing is your answer—you assemble it right on the job from stock UNISTRUT channel and fittings. Concrete inserts, clamps, insulators—all are available in the complete UNISTRUT System. Costly welding, drilling and riveting are eliminated—with UNISTRUT, everything bolts together; fittings are attached and adjustments made while work progresses. And you get a clean, professional installation strong enough to support the heaviest run.

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NEWS ABOUT PEOPLE

Montgomery and Johnson Advanced by NSP

Northern States Power Co has elected D. T. Montgomery as vice president and treasurer and G. F. Johnson as vice president-finance. Montgomery, vice president and controller since last year, succeeds L. F. Chambers as treasurer.

Chambers, who has retired, is former vice president and treasurer, and also served as principal financial officer. The latter post has been assumed by Pres Allen S. King.

Montgomery, a 42-year NSP veteran, will now be the utility's principal accounting officer. He joined the firm's accounting department in 1914 and until 1926 served in branch and division offices. He then transferred to the Minneapolis general office and held successive posts as accountant, auditor, controller and assistant treasurer.

Johnson joined NSP in 1927 upon receiving an electrical engineering degree from University of Minnesota.

D. T. MONTGOMERY

After serving as rate engineer for 25 years he was named operations controller in 1952. He has served as assistant vice president-finance of the utility for the past year.

G. F. JOHNSON

In addition, A. L. Burgess has been named comptroller and continues as assistant treasurer, and A. G. Shogren becomes assistant treasurer and assistant comptroller.

Hollingsworth Promoted to VP

New vice president and Augusta Division manager of Georgia Power Co is W. E. Hollingsworth, formerly assistant division manager in Augusta. He replaces T. A. Gibson who has retired.

The new vice president has been with Georgia Power and predecessors since 1926, when he was named local manager at Ocilla. Nine years later he was promoted to Tifton district manager and was appointed assistant superintendent of the Columbus Division in 1936. The following year he became assistant superintendent of the Macon Division and rose to Macon Division superintendent in 1946. Hollingsworth has served as assistant division manager in Augusta from 1953 until his recent appointment.

W. E. HOLLINGSWORTH

Mitchell Appointed Comptroller

Philadelphia Electric Co has announced the appointment of Allan G. Mitchell as comptroller of the utility.

A graduate of Rutgers University, New Jersey, with a civil engineering degree, Mitchell joined Philadelphia Electric in 1931 as a technical assistant in the finance and accounting department. After serving in various capacities, he advanced to the post of statistician, the position he held at the time of his recent appointment.

Mitchell is a past president of the Financial Analysts of Philadelphia and a member of the Economists Division Group of Philadelphia.

ALLAN G. MITCHELL

Transportation. The 4-Wheel-Drive 'Jeep' Truck's go-anywhere ability takes crews and equipment to meet service emergencies, over good roads or no roads, in good or bad weather—along the right-of-way or to off-road structures where other vehicles can't go.

Only 4-Wheel-Drive 'Jeep' Vehicles meet every service emergency!

Trenching. The 'Jeep'-propelled trencher digs up to 800 feet of clean-cut trench per hour, to speed the installation of cable, conduit and service lines. Travels safely on the highway at top legal speeds between jobs.

Maintenance. With the extra traction of its 4-wheel drive, the versatile Universal 'Jeep' gets through to trouble spots, on the road or off, with sure dependability. It helps speed installations, keeps service and maintenance schedules up-to-date.

Whether carrying an underground detail with cable splicing equipment or helping work crews string high wire, 'Jeep' vehicles work 'round-the-clock in electrical industry service.

Time-tested, performance-proved go-anywhere 'Jeep' transportation virtually assures uninterrupted customer service. In emergencies, the extra traction of 4-Wheel-Drive 'Jeep' Vehicles carries men, tools and equipment through mud, sand, soft earth or up steep grades—in heavy rain, snow or other emergencies of weather—to reach tower, substation, service lines or wherever repairs are needed. On the highway, 'Jeep' vehicles travel in conventional 2-wheel drive at top legal speeds.

For hundreds of different jobs, from installing meters to patrolling the right-of-way, rugged 'Jeep' vehicles serve the electrical industry. Ask your Willys dealer for a practical on-the-job demonstration today, or write for information.

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family of 4-Wheel-Drive Vehicles

WILLYS... makers of the world's most useful vehicles

WILLYS MOTORS, INC., TOLEDO 1, OHIO

Gehrels Elected Ebasco International VP

August S. Gehrels has recently been promoted to vice president of Ebasco International Corp, a subsidiary of American & Foreign Power Co.

Formerly executive vice president of the Cuban Electric Co, Gehrels was transferred from Cuba to his new post in New York. In this new capacity, he will be concerned with American & Foreign Power Co operations in the Caribbean area.

Gehrels, who attended the New Mexico School of Mines, has been affiliated with various companies in the American & Foreign Power system since 1928.

AUGUST S. GEHRELS

TVA Elevates Leonard to Chief Engineer

Tennessee Valley Authority has announced the promotion of George K. Leonard to chief engineer.

Leonard joined TVA in 1933 as assistant engineer on Wheeler Dam and prior to his new post served as chief construction engineer. In the interim, he was affiliated with such projects as Guntersville, Cherokee, Watauga, and South Holston Dams.

He is succeeding Clarence E. Blee, former chief engineer for 13 years, who is retiring effective Jan. 1. Blee, who previously spent 24 years as an engineer on the Pacific Coast, joined TVA in 1935.

GEORGE K. LEONARD

PERSONAL BRIEFS

Newly organized Power Division of Public Service Co of New Hampshire has elected **Harold S. Swain** manager.

Leslie M. Cooper has been promoted to supervisor of distribution rights-of-way for Jersey Central Power & Light Co and **Oliver D. Bennett** as acting supervisor, distribution rights-of-way; **Eugene E. Jones** is assistant to the manager of rights-of-way.

Ohio Valley Electric Corp and its subsidiary, Indiana-Kentucky Electric Corp, have announced the appointment of **Kenneth W. Brown** as general auditor.

Robert B. Rankin has been promoted to superintendent of Pittsfield subgroup operations of Central Illinois Public Service Co, succeeding the late **H. C. Winston.**

J. Donald Hogg, formerly purchasing agent for Cleveland Electric Illuminating Co, has been promoted to manager of purchasing department . . . New personnel department manager at CEI is **Frederick C. Prasse.**

Wilbur I. Adams has been named office manager, Somerville branch of Public Service Electric & Gas Co, succeeding **Philip C. Carolan,** retired.

Public Service Co of Oklahoma announces the appointment of **Jacques Cunningham** as manager of Tulsa Division, succeeding **H. S. Kilby,** retired.

Thomas W. Miles, in addition to serving the Council of State Chamber of Commerce as public relations advisor, has established a private practice in public relations in Washington, specializing in atomic energy.

Iowa Southern Utilities Co has designated **Darrell E. Reed** manager of its Mt. Ayr district to fill the vacancy created by **Alvin L. Varner's** transfer to Leon district as manager.

Nathaniel B. Knight, Jr, will be chairman of the Louisiana Public Service Commission for the next two years. **Ernest Clements** has been selected to succeed **Earl P. Roy,** commissioner, who will serve out the term vacated by the late **Wade O. Martin, Sr.**

Retired **Brigadier General Miles W. Dawson** becomes manager of newly organized distribution services department of Westinghouse Electric Corp.

W. W. Gilmore is new vice president of Minneapolis-Honeywell Regulator Co in addition to being president of M-H Micro Switch Division.

H. M. Harper Co has upped **H. M. Harper, Jr,** formerly pricing manager, to assistant to the president.

J. D. Reynolds was elected a vice president of the Reynolds Metals Co.

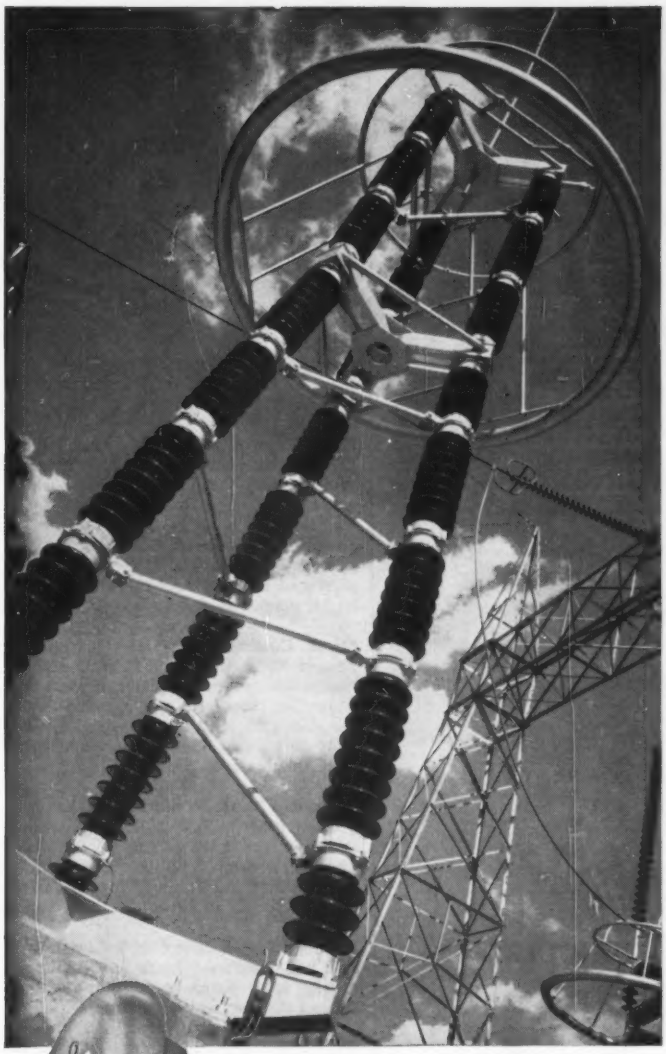
Recent appointments at Pittsburgh Steel Co made **Marvin J. Bair** vice president of sales. He is succeeded by **John C. Cercone** as general manager of sales.

Federal Caribe, Inc, a division of Federal Telephone and Radio Co, has appointed **D. W. Black** vice president and general manager.

Radio Corporation of America has elected **Edwin C. Tracy** as manager of the broadcast and television equipment department. Tracy succeeds **A. R. Hopkins** who was promoted to the newly created post of manager of RCA commercial electronic marketing department.

Truman Young has new post of advertising and sales promotion manager for Walter Kidde & Co, Inc. Young will also continue his former duties as manager of market development.

Binkley Manufacturing Co has announced the appointment of **Owen W. Hetzler,** formerly assistant superintendent of meter and service department for Kansas City Power & Light Co, to manager of the Utilities Division.



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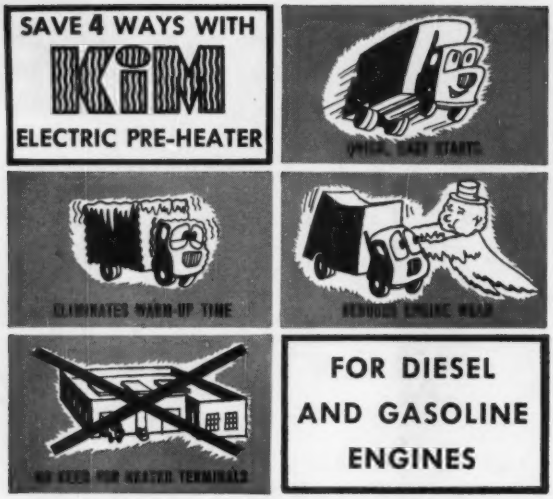

KIM Hotstart keeps engines warm at night. It is a lightweight pre-heater that is plugged into the electric circuit. KIM draws off cold water from the engine, heats and circulates it through the engine. KIM's use ends cold starts, and cuts winter repair bills. Thousands in use.

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94

SALES ASSIGNMENTS

COMPANY STAFFS

Ansul Chemical Co has appointed L. Thomas Plouff, former manager of sales analysis and control, to export sales manager to succeed the late C. Bernard Beidler. David Piszcek assumes the post vacated by Plouff.

General Motors' Electro-Motive Division has advanced M. W. Mount from district engineer to regional sales engineer on the West Coast.

Miller Co's new sales representative for the Columbus-Central Ohio territory is Don W. Houser.

Radio Corp of America has named J. F. O'Brien manager of its Northeastern region, with headquarters in Boston, Mass.

Joseph T. Ryerson & Son, Inc, has appointed Clive C. Earle as manager of alloy and stainless steel sales at its Pittsburgh plant.

States Co has designated Charles H. Russell, R. W. Kraft, and L. Walter Kline representatives in Virginia, District of Columbia, southern and western West Virginia, and southern Maryland. New representative in Saskatchewan and British Columbia is N. D. Schell.

Sylvania Electric Products, Inc, has appointed Marvin V. Schylling as district sales manager in the St. Louis area for its Lighting Division. William L. Friend is newly named Pacific Coast regional sales manager for the division.

Westinghouse Electric Corp's Lamp Division has designated Louis L. Nealon as district sales manager of the Belmont (Mass.) district, which comprises Maine, New Hampshire, Vermont, and eastern Massachusetts. . . . Arthur A. Currie is new assistant general sales manager of the company's Television-Radio Division. . . . Robert A. Myers is new district manager of portable appliances with the firm's central region, Cleveland. He succeeds John MacMorris, now sales training supervisor for electric housewares, Electric Appliance Division.

REPRESENTATIVES

Radio Corp of America's new manufacturers representatives for the new line of special laboratory test apparatus are G. S. Marshall Co of Pasadena, Calif., for California, Arizona, and Nevada; Burt C. Porter Co of Seattle, Wash., covering Washington, Oregon, western Idaho, and western Montana; and Williams & Associates of Denver, Colo., for Colorado, Wyoming, Utah, New Mexico, and eastern Idaho.

Western Precipitation Corp has named Marshall, Neil & Pauley, Inc, as agents for the sales of Multiclone and Dualaire products in the major part of Texas.

Pioneers 290-Mw

(*Continued from page* 113)

will be type 316 austenitic stainless steel.

Coal will be supplied from six silos per boiler, with a total capacity for 4 hr of burning. Backup for the silos will be a coal pile in the yard, such as is now in use at the company's Burlington Station (EW, May 14, p 110). Outdoor coal pulverizers will be under an extension of the operating floor which will also shelter the primary air fans.

Two 26-ft condensers, one for each low-pressure exhausting element, will be connected by a common outlet water box between the two turbine shafts of each unit. Flexible connections on both sides of the common water box will allow for differences in expansion between the two low-pressure elements.

One centralized control room will be situated at the intersection of the diagonals formed by the boilers and generators of the two units. Centrifugal air compressors will supply all air service requirements.

How Soon Will There Be Another Atlantic Cable?

London — (McGraw-Hill WORLD NEWS)—Another transatlantic telephone cable may well be in the offing in the not too distant future because of the impetus given the growth of communication between western Europe and North America recently by the inauguration of the first voice cable. At least, that's the word from Sir Gordon Radley in his recent presidential address to the London Institution of Electrical Engineers. Eighty circuits on a single cable, or 200 in a twin-cable system, would be an objective only a little outside present cable repeater capabilities. Repeaters are the amplifiers in the cable that boost the power of the voice more than a millionfold every 40 miles.

They contain many components, tubes, coils etc., that must be precision engineered to last many years on the ocean bottom. Their design, and that of the equipment necessary to house, handle and install them in the cable at sea, are the principal difficulties to be overcome, according to Sir Gordon.

"After all, is there really much difference in switches?"

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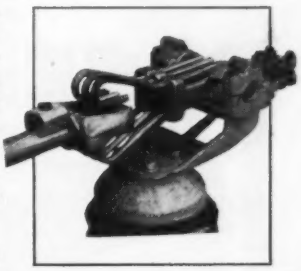
When you install a switch, it *must* be built to last—for years. Quality of materials and simplicity of operation are the keys to long life—and they're found in *every* Royal switch. For example, the VVL vertical break shown here has only 10 separate parts above the insulators in the final assembly of each pole — fewer moving parts for rugged, reliable operation.

The Royal VVL switch was the *first* to eliminate the use of braid shunts on the hinge contact, further simplifying operation. Permanently sealed aircraft type lifetime bearings eliminate maintenance. Future ground switch installation on all Royal switches is accomplished without completely dismantling the main switch.

EVERY ROYAL SWITCH EXCEEDS MINIMUM STANDARDS IN *EVERY* RESPECT. Make a date to see a Royal switch "in person"—Write today.



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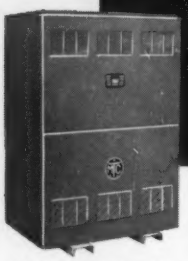

450 KVA, three phase, dry type transformer. Primary 480 Secondary 208Y/120, 4—2 1/2% FCBN

The Beverly Hilton uses only the finest, from champagne to transformers.

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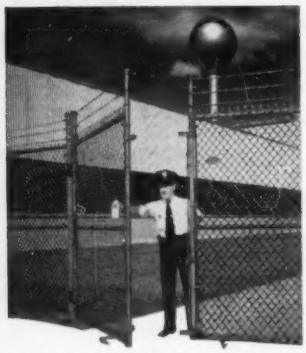

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PEA Meter Meeting

. . . hears 3 manufacturers describe equipment for load survey and demand billing

Three manufacturers reported progress to Pennsylvania Electric Association's Meter Committee in developing a double-duty load survey recorder and demand billing meter. The group met Oct. 18-19 at Split Rock Lodge, White Haven, Pa.

Presentations were made by Martin Lyford, systems engineer, Fischer & Porter Co, Hatboro, Pa.; Martin W. Hellar, Jr, manager of advance development engineering, meter department, General Electric Co, Somersworth, N. H.; and Kenneth Campbell, engineer, meter department, Westinghouse Electric Corp, Raleigh, N. C.

• Fischer & Porter's approach has resulted in a Digital Demand Recorder that is now on the market. Lyford declared that it "does both the job of load research and customer demand billing (See page 137)."

The recorder automatically produces a visually readable punched tape record of watthour demand taken at 15, 30, or 60-min intervals. The tape can be read manually or processed by a F&P Automatic Tape Translator operating a card punch machine such as the IBM 526.

• General Electric is designing and developing a "demand meter for use with automatic data processing equipment," Hellar said. The device is not yet in production but is expected to be suitable for application to survey work and automatic billing.

GE's meter automatically produces a coded punched tape of watthour demand taken at 15, 30, or 60-min intervals. The tape is then processed utilizing "standard translators available commercially as attachments to present computers and data processing equipment."

• The Westinghouse approach has resulted in a Load Survey Recorder that will be in production soon. Campbell told the group that "there is reason to believe that this or a similar instrument can be suitable for performance as a billing meter."

It automatically records demand at 15, 30, or 60-min intervals on standard magnetic tape. The data is then processed through a translator and fed directly to a card punch machine such as the IBM 526.

Design Features . . .

of CEI's Eastlake Plant are reported to EEI Electrical Equipment Committee

Installation this year of the first turbine-generator having liquid-cooled stator coils at Eastlake Plant of Cleveland Electric Illuminating Co has resulted in a net station heat rate of 9,336 Btu per kwhr, a building volume of 17.5 cu ft per kw, and an overall on-site investment cost of $117 per kw of gross capability.

These and other operating, design, and investment data on the new unit were given members of the Electrical Equipment Committee of the Edison Electric Institute at Cleveland last month by J. P. Fitzgerald and C. F. Paulus.

The pioneer liquid-cooled generating unit is normally operated at 240 Mw with a heat rate of 9,145 Btu per kwhr. It is rated 208 Mw, 260 Mva at 30 psi hydrogen. The three other machines at Eastlake are rated 125 Mw, 156,250 Mva at 30 psi hydrogen and are normally operated at 140 Mw.

Generator Has Notable Features

Notable features of the liquid-cooled generator mentioned were these:

- Use of a motor-generator exciter rather than shaft-driven exciter and elimination of the spare.
- Use of Transil oil as the cooling liquid in the hollow armature conductors.
- Use of a forced-cooled isolated-phase bus for generator connections that is designed for 10,000 amp at 18,000 v.
- Power for auxiliary motors as large as 4,000 hp and the auxiliary load of 20,000 kva for the liquid-cooled unit is supplied at 4,160 v using 250-Mva switchgear.

Substation Design Discussed

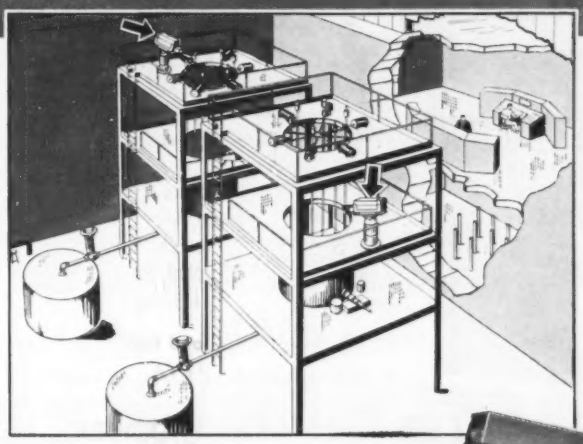
Development of basic substation designs and their application on the Columbus & Southern Ohio Electric Co system were described by F. V. Stine.

Prefabricated substation steel has come into use bringing a number of

(*Continued on next page*)

Diamond "UtiliVue" (WIRED TELEVISION)

used in NUCLEAR REACTOR STUDIES at Battelle Memorial Institute



Arrows indicate remotely controlled "UtiliVue" Cameras that SEE experimental nuclear reactor cores.

"UtiliVue" pedestal enables camera to be rotated 320° and tilted 90° by remote control from console. Zoom lens (also controlled from console) brings objects into focus at widely varying distances from camera.

"UtiliVue" Monitor is built into control console in separate control room where experimental nuclear reactor cores can be WATCHED in perfect safety.

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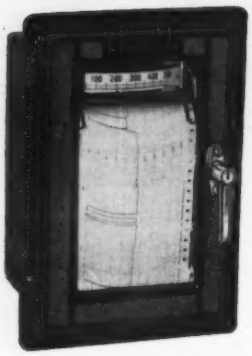

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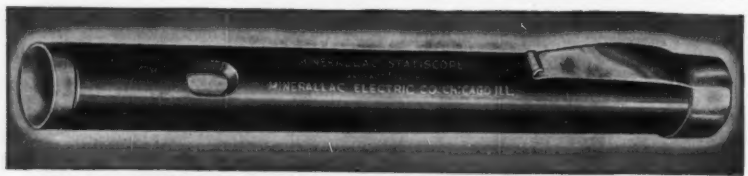

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. . . when held in any alternating electrical field. Indicates presence of voltage in AC and Pulsating DC Circuits and in various electrical apparatus. . . . Pocket-size illustrated above, also in Station and Overhead Extension types. Thousands in use. Order from Electrical Jobber. Send for new literature.

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savings. Among them Stine cited: Use of the same drawing to show equipment location and steel erection information, elimination of extra drawings for steel erection and steel details, and reduction in field erection time.

Rigid Tubing Used

Rigid copper tubing bus is used in all substation bus work because radio and television interference from slack insulator strings has excluded strain buses wherever possible.

Open-type steel structures are used for all 13-kv stations in preference to metal-clad switchgear, Stine said, because space is not usually a problem and because average cost of a 13-kv feeder position in the open structure is 55% of the cost of equivalent metal-clad switchgear.

In a number of cases where available fault current has been low enough, 3-phase oil circuit reclosers have been used instead of oil circuit breakers because the recloser is more economical, faster in opening than the OCB, and their operation has been satisfactory.

TECHNICAL LITERATURE

ANCHOR RODS: Bulletin TD-2, 1956, gives the specifications for strand-eye anchor rods as approved by the Transmission and Distribution Committee, Edison Electric Institute. It is felt this booklet will be instrumental in promoting simplification and uniformity of requirements for anchor rods and other products. For use by member companies. Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y.

OIL AND GAS ENGINES—The Subcommittee on Oil and Gas Engine Power Costs of the American Society of Mechanical Engineers has issued its report for 1955. It contains operating cost data from 124 plants, including performance and production cost. Price $2.50. Write American Society of Mechanical Engineers, 29 W. 39 Street, New York 18, N. Y.

NATIONAL ELECTRICAL CODE — "Analysis of the 1956 Revision of the National Electrical Code," the latest in a 25-year series of reference reviews of code revisions published by NEMA, has been completed and is available. The new booklet details all changes made in the former edition, and is said to eliminate the need for the Code user to make comparisons between the new and old documents. It is intended to show the nature of the changes that have occurred in the Code since the 1953 edition. 45 pages, 25¢. Write National Electrical Manufacturers Association, 155 E. 44 Street, New York 17, N. Y.

STANDARDS—Proof of the value of standardization in the electrical manufacturing and electronics fields is stressed in an extensive survey report entitled, "Dollar Savings Through Standards." This 40-page survey is available through American Standards Association, and is an up-to-date version of the original report done in 1951. It contains 79 documented cases covering 27 industrial fields. Of special interest to EW readers should be those covering electrical manufacturing and electronics, power generation, air-conditioning equipment, electric utilities, iron and steel, non-ferrous metals, rubber manufacturing and aluminum. May be obtained on written request from American Standards Association, 70 E. 45 Street, New York 17, N. Y.

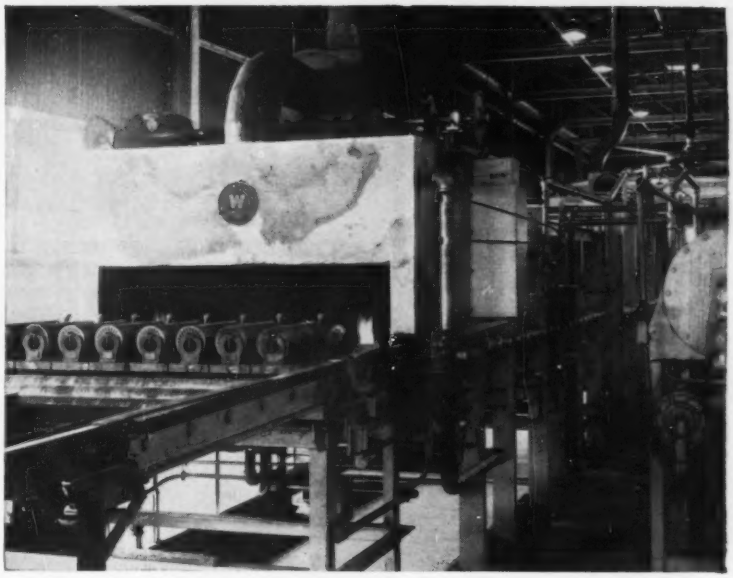
INSULATION—The "IMC Electrical Insulation Manual" is reference book on all the commonly used electrical insulating materials. Sixteen sections and more than 300 pages have been assembled, giving technical information, product data, and references to specifications previously published. In addition, the manual gives applicable AIEE, ASTM, NEMA and similar societies' standards to assist in the evaluation of products. Plastic ring bound, price $5. Write Insulation Manufacturers Association, 565 W. Washington Blvd, Chicago 6, Ill.

THERMAL ASPECTS OF LIGHTING SYSTEMS—A 31-page booklet provides a report on the relationship between lighting and other factors that enter into the problems of air conditioning. The thermal aspects of the lighting system and its relation to the cooling load is emphasized. 75¢ a copy. Write American Society of Heating & Air Conditioning Engineers, 62 Worth St., New York 13, N. Y.

IRRADIATION—The effects of irradiation of metals in atomic reactors is the subject of a 54-page book on "Nuclear Metallurgy" published by the American Institute of Mining, Metallurgical, and Petroleum Engineers. Price $3.67. Address your order to the American Institute of Mining, Metallurgical, and Petroleum Engineers, 29 W. 39 Street, New York 18, N. Y.

AIR CONDITIONING—A 4-page pamphlet by Drayer-Hanson, entitled, "Water Coil Selection Method" is available to those in the industry interested in the problems encountered in selection of coils and tubes for air conditioning plants. The computation of coil size and tube facing can be determined by a relatively simple 6-step method, the number of rows of coils required by an equally simple 4-step procedure. An alternative procedure for the latter is also outlined. There are also charts on sensible heat ratio, GPM/tube, and water friction. Request leaflet FM-J.561L fro Drayer-Hanson, 3301 Medford Street, Los Angeles 63, Calif. There is no charge for this pamphlet.

IMPULSE TESTING—"High Voltage Impulse Testing" is the name of a publication describing the effects of lightning strikes on transmission systems, both overhead and underground. Data for the booklet was obtained in the High Voltage Laboratory of the National Physical Laboratory in Great Britain. The methods of testing insulators, protective gaps, cables, transformers, and capacitors are dealt with. Ask for Notes on Applied Science, No. 17. Price 27¢. Write Department of Scientific & Industrial Research, Charles House, 5-11 Regent Street, London, S. W. 1, England.

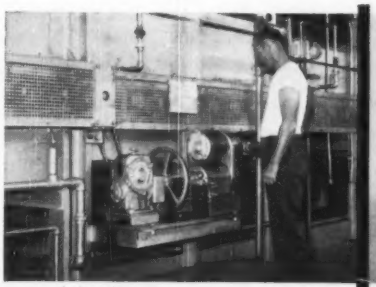


How does ONAN Emergency Electricity protect this electric roller hearth furnace?

This furnace operates at 1400° F. Inside are a series of steel rollers driven by an electric motor, which turn at low speed and move pallets loaded with metal parts through the furnace. If these rollers should stop turning for as short a period as 5 minutes . . . deformation will occur and the rollers must be replaced. This is a very costly repair.

To guard against this loss and to keep the furnace operating, the company installed an Onan 3,500-watt emergency electric plant with completely automatic controls. Now . . . if regular service is interrupted, the plant starts automatically and takes over the power load. It keeps the 3½ H.P. electric motors running and supplies 1,000 watts for emergency lighting.

Where an industrial process cannot be interrupted without serious loss . . . an Onan Emergency Electric Plant may pay its entire cost several times a year. Ask your consulting engineer, or electrical contractor about Onan Standby Power . . . or write us for information.



This is one of the electric motors on the emergency power circuit. Power is transmitted through the gear reducer in the foreground to drive furnace rollers at very low speed.

The Onan 3,500-watt emergency plant is installed in the plant 300 feet from the furnace. Automatic start and stop control is located near the furnace.

WRITE FOR FOLDER ON EMERGENCY POWER

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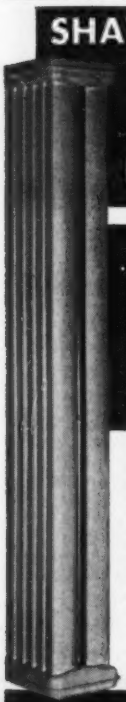

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TVA Industry . . .

. . . will need 34-billion kwhr by 1970, productivity forum is told

An electric power official has warned in Nashville that Tennessee's industry will need 34 billion kwhr in 1970 to reap economic benefits of the expected population increase.

Addressing a one-day industrial productivity forum, W. E. Landers, manager of Murfreesboro, Tenn., Electric Dept, said:

"And that is more than the TVA system's entire output for all uses just two years ago."

The forum, attended by more than 300 Tennessee business and industrial officials, centered on the theme: "New Ideas for Increased Production and More Net Profit."

It was sponsored by the Nashville Electric Service, Central District Managers Assoc., and General Electric Co.

"It is my opinion that there is a definite connection betwen the number of job opportunities in industry and the amount of power that we must provide to industry," Landers said.

Kwhr per Man Climbing Fast

"In 1955, manufacturers in Tennessee used an average of 31,550 kwhr for each worker employed. The first six months of this year indicate that an average of 34,000 will be used by each worker.

"We are providing 8% more power per worker today than last year without considering any increase in employment. This is the advent of automation."

APC Gets Dam OK

Alabama's Public Service Commission has approved plans of Alabama Power Co for construction of a dam on the Warrior River near Jasper, plus installation of generating facilities in Lock 17 at Tuscaloosa, at an estimated total cost of $31 million.

The utility earlier obtained a preliminary permit for the projects from the Federal Power Commission, and now seeks an FPC license to proceed with construction. The proposed project on Sipsey fork of Warrior River will produce 160 Mw ultimately.

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ELECTRICAL WORLD

330 W. 42nd St.

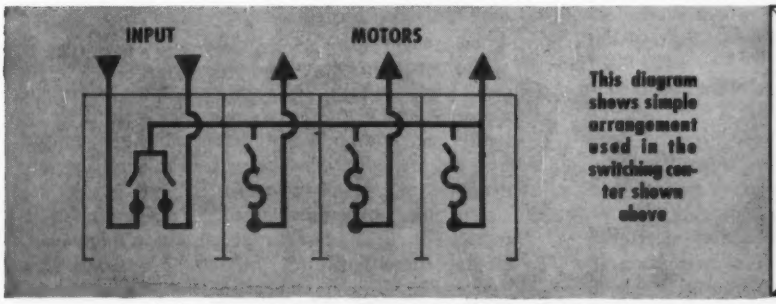
New York 36, N. Y.

The man with his coat off is Carl Christiansen, 3E Sales Engineer, pointing out the features of a 3E Switching Center built for a large automobile manufacturer.

3E builds to meet the specs . . .
. . . *no need to compromise*

3E engineering and standard components solve a wide range of unique requirements.
There is often a temptation to sacrifice a measure of efficient design in favor of easily available standard units. At 3E we believe that equipment engineered to fit job requirements without compromise is not only economical —it is the best way to protect *your responsibility for safe precise control of power.*

The switching center shown above was built for a major auto manufacturer. It is typical of the many cases where there is *no standard package* that can do the job. The unit handles a 4800 volt input distributed to two 300 H.P. motors and one 200 H.P. motor used to drive high frequency generators. The use of 3E's **Auto Speed Load Interrupter Switches** and 3E design produced a compact, rugged switching center at a practical cost.



This diagram shows simple arrangement used in the switching center shown above

3E

ELECTRICAL ENGINEERS EQUIPMENT CO. Melrose Park, Illinois
Representatives in principal cities—in Canada by Power-Lite Devices, Ltd.

THE SHORTAGE OF SCIENTISTS AND ENGINEERS:

What Can Be Done About It?

There is no easy or quick way to overcome the shortage of scientists and engineers that has become a threat to our national security and economic progress. The solution can come only through diligent efforts extending over several years to bring the supply of technically trained people into balance with our needs. Meanwhile, the pressure of the shortage can be relieved if industry, government and education make better use of the limited number of scientists and engineers now available.

Earlier editorials in this series have discussed the dimensions of the shortage of technical manpower, its meaning for our national security and our economic well-being and the causes of the shortage. This final editorial will survey some of the measures that can be taken to overcome the shortage. Most of the proposals presented here have been suggested elsewhere. But in combination they appear to offer the best hope of an answer to this serious national problem.

Soviet Methods Not For U. S.

It is clear that no crash program, inspired by panic and designed indiscriminately to drive hordes of high school students into science and engineering, is suitable for the United States. Even if we adopted Soviet methods of channeling a large portion of our brightest young people into technical fields, it would be at least four years before results appeared in the volume of college graduates. And such an approach would do no credit to the American way of life.

Any crash program, whether it involved totalitarian methods or simply overselling the advantages of technical careers, would be objectionable for other reasons as well. It would jeopardize the quality of scientific and engineering training. It would put many young people in fields where they have little aptitude and deny them to other fields for which they are better equipped. And, if carried too far, it might even result in the overcrowding that was feared prematurely a few years ago.

The most important problems for the long run, as the preceding editorial in this series indicated, are in the area of education. Any real solution must reduce the loss of talented high school graduates who do not continue their education for financial reasons or because of lack of interest. Also, it must improve the quality of high school preparation in science and mathematics and, above all, relieve the critical shortage of teachers.

Basic Needs in Education

Substantial increases in salaries of teachers in most of the nation's school systems are essential if high school students are to receive adequate preparation for courses in science and engineering. Pay scales that have lagged behind rising living costs and salaries available in industry have placed great strain on even the most devoted teachers. There has been a sharp drop in the number of new graduates trained to teach science and mathematics, and of this smaller number many have decided not to follow careers in teaching.

Raising teachers' salaries to more realistic levels must be primarily the job of local school districts, aided by state governments. If, in face of rapid increases in school enrollments, local and state resources prove insufficient, then federal aid will have to be considered. Higher teachers' salaries, however financed, inevitably mean higher taxes. But without appreciable improvement soon, the quality of our entire educational system is in danger.

At the college level also, financial aid is needed to provide scholarships for promising students and to increase faculty salaries. (An earlier series of editorials dealt more fully with these problems, and business aid to higher educational institutions has been mounting at a gratifying rate.)

But not all the educational problems related to the shortage of scientists and engineers can be solved with money. Science and mathematics have steadily been de-emphasized as more youngsters have gone to high school for terminal education rather

How business is helping to relieve the shortage of technical manpower

Summary of a Survey by McGraw-Hill Correspondents

- Sponsoring summer study programs for high school teachers
- Arranging cooperative work-and-study programs for students
- Sponsoring college fellowships and scholarships in science and engineering
- Paying tuition of employees taking science and engineering courses
- Keeping college faculties abreast of new developments in industry
- Hiring high school science teachers for summer and part-time work
- Giving old, but usable, laboratory equipment to schools
- Cooperating in high school science exhibits
- Sponsoring regional science fairs
- Sending speakers and training aids to schools
- Opening plants for student tours
- Analyzing jobs to relieve engineers and scientists of routine work

The McGraw-Hill Department of Economics will be glad to hear of any other ways business is helping relieve the shortage.

than for college preparation. This de-emphasis must be reversed.

Techniques of instruction, furthermore, can stand improvement at all levels of education. Professor E. P. Northrup of the University of Chicago observes: "In the past fifty years . . . there has been a revolutionary change in the character of mathematics, yet not a trace of this change is to be found in the curricula of all but a handful of secondary schools throughout the country." Colleges and universities may have to examine old fetishes about light teaching loads and small classes in order to make more efficient use of their faculties.

What Industry Can Do

Industry has the immediate problem of better utilization of available technical manpower and the long-range responsibility of helping increase our resources of trained people. Frantic recruiting practices and reckless bidding up of starting salaries—financed largely by government money for defense orders — are not the answer. There is need for earnest consideration of incentives for experienced scientists and engineers, who too often must look to sales or executive positions for adequate financial recognition.

Industry in many instances could make more efficient use of engineers and scientists by shifting work to technicians, clerical personnel and even machines. One company found that 15% of the time of an engineering design group was spent on routine jobs and that this valuable time could be saved by adding a technician and a clerical worker to the group.

Other potential sources of technical manpower could be tapped more extensively to relieve the shortage. Very few women have entered what has been traditionally a man's world. Negroes are only slowly gaining educational and employment opportunities in technical fields. And many experienced older men can still give useful service.

A Good Beginning

Much is being accomplished already in efforts to attract more young people into scientific and engineering careers. A summary of some of the things business is doing is presented above. Other notable contributions are being made by such organizations as the professional engineering and scientific societies (especially through their manpower commissions), the National Science Foundation, the National Research Council, the National Education Association, the National Merit Scholarship Foundation and the Thomas Alva Edison Foundation.

Results are beginning to appear in rising enrollments in engineering schools and technical institutes. Between 1951 and last year, according to McGraw-Hill's annual survey of technical institutes, enrollments in these schools rose from 46,000 to a record 67,000. Engineering enrollments rose in the same period from 166,000 to 243,000. A rising tide of graduates is already being made available to American industry.

This is a good beginning. But only with wider appreciation of the serious implications of the shortage of scientists and engineers and intensified efforts on the part of business, government and education to relieve the shortage can we hope to overcome this threat to our national security and economic well-being.

This is one of a series of editorials prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments of particular concern to the business and professional community served by our industrial and technical publications.

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Donald C. McGraw

PRESIDENT

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Joe Braddick, Fairfax 3-2401, Houston, Texas
Bill Milligan, Tucker 1540, Los Angeles, Calif.
Don Palmer, Douglas 2-4082, San Francisco, Calif.

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P-2939, Electrical World
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3	5000	G.E.	38100/66000–6600
4	3333	G.E.	38100/66000Y—33000
4	3125	Mol.	39900/66000Y—26600/46000Y
3	3333	G.E.	33000/11000—2400/7200
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MEETINGS CALENDAR

NOVEMBER

National Rural Electric Association—Region Nine Annual Meeting, Davenport Hotel, Spokane, Wash., Nov. 12-13.

National Electrical Manufacturers Association—Annual Meeting, Traymore Hotel, Atlantic City, New Jersey, Nov. 12-16.

Edison Electric Institute—Industrial Relations Committee, EEI Headquarters, New York, N. Y., Nov. 15; Industrial Power & Heating Group, Detroit, Mich., Nov. 15-16; EEI-AGA General Accounting Committees, Henry Grady Hotel, Atlanta, Ga., Nov. 26-27; Accident Prevention Committee, Statler Hotel, Hartford, Conn., Nov. 26-28.

Pacific Coast Electric Association, Inc—Administrative Services Section, Hotel Biltmore, Santa Barbara, Calif., Nov. 14-15.

American Society of Refrigerating Engineers—43rd Semi-Annual Meeting, Hotel Statler, Boston, Massachusetts, November 25-28.

Inland Empire Waterways—23rd Annual Convention, Chinook Hotel, Yakima, Washington, Nov. 26-27.

• **American Society of Mechanical Engineers**—Annual Meeting, Statler and Sheraton-McAlpin Hotels, New York City, Nov. 25-30; 22nd National Exposition of Power and Mechanical Engineering, Coliseum, New York City, Nov. 26-30.

Third International Automation Exposition—New York Trade Show Bldg., N. Y., Nov. 26-30.

Great Lakes Conferences of Railroad and Utilities Commissioners—First Annual Convention, Greenbrier Hotel, White Sulphur Springs, W. Va., Nov. 29-30.

DECEMBER

• **Electrical World**—Electrical Space Heating and Heat Pump Conference, Barbizan-Plaza Hotel, New York City, New York, December 5-6.

Institute of Radio Engineers—2nd Instrumentation Conference, Biltmore Hotel, Atlanta, Ga., Dec. 5-7.

Edison Electric Institute—1957 Conference Planning Committee, sponsored jointly with American Gas Association, EEI-AGA Headquarters, New York, Dec. 6-7; Street Lighting Committee, Dayton, Ohio, Dec. 6-7; Commercial Cooking & Water Heating Committee, Cleveland, Ohio, Dec. 13-14.

JANUARY, 1957

Northeastern Weed Control Conference — Sheraton-McAlpin Hotel, New York City, Jan. 10-12.

Doble Engineering Co—24th Annual Conference of Doble Clients, Sheraton-Plaza Hotel, Boston, January 14-18.

Southeastern Electric Exchange—Personal Administration Section Meeting, held jointly with EEI, Sheraton-Park Hotel, Washington, D. C., Jan. 17-19.

American Institute of Electrical Engineers—Winter General Meeting, Hotel Statler, New York, Jan. 21-25.

Missouri Valley Electric Association—Industrial & Commercial Sales Conference, Hotel President, Kansas City, Mo., Jan. 31-Feb. 1.

FEBRUARY

National Association of Purchasing Agents—26th Annual Mid-Winter Conference, Public Utility Buyers' Group, Brown Hotel, Louisville, Ky., February 3-5.

• **National Electrical Week**—Second Annual Observance, Feb. 10-16.

Electric Institute of Washington—Electrical Trade Conference & Exposition, Shoreham Hotel, Washington, D. C., February 12-14.

American Institute of Electrical Engineers—1957 Transistor & Solid State Circuits Conference, sponsored jointly with Institute of Radio Engineers and University of Pennsylvania, University of Pennsylvania, Philadelphia, Pa., Feb. 14-15.

Pacific Coast Electrical Association—Business Development Section, Sheraton-Palace Hotel, San Francisco, Calif., Feb. 28-Mar. 1.

American Society of Heating and Air-Conditioning Engineers—63rd Annual Meeting, Chicago, Ill., Feb. 25-28.

• Additions this week.

Men Work at Night on Lighted Bridge

Lights strung across the Straits of Mackinac bridge enable work to be continued at night on this, the world's largest suspension-type bridge. The picture was taken from St. Ignace side. The bridge will link St. Ignace with Mackinac City, Mich., a distance of 8,614 ft. The bridge's center span is 3,800 ft. Each tower rises 552 ft. from the water.

P&K ALL-ALUMINUM STANDARDS AND ARMS:

ROOSEVELT BOULEVARD, PHILADELPHIA, WHERE 1,000 NEW LIGHTS ON P & K ALL-ALUMINUM STANDARDS AND ARMS WILL MARK THE LAUNCHING OF PERHAPS THE MOST FAR-SIGHTED STREET LIGHTING PROGRAM OF ALL TIME.

AT THE END OF A 10 YEAR PROGRAM 70,000 STREET LIGHTS WILL HAVE BEEN INSTALLED AND MODERNIZED. ALL POLES, BRACKETS AND LUMINAIRES BEING USED ARE ALUMINUM.

MR. HAROLD E. MASON
Street Lighting Engineer
City of Philadelphia

THE LOGICAL CHOICE IN PHILADELPHIA

Like their 500 P & K predecessors installed in the "World's Workshop" years ago, these new P & K 32-ft. All-Aluminum Standards, and P & K 12-ft. Tapered Elliptical Arms will prove *the wisest investment in modern lighting.*

LIGHT-WEIGHT, HIGH STRENGTH, AND CORROSION-FREE FOR EASY INSTALLATION AND LONGEST LIFE.

NO NEED FOR PROTECTIVE MAINTENANCE, NEVER NEED PAINTING.

NO SEAMS, NO FRILLS, NO SCROLLS, NO TIE-RODS. ITS MODERN SIMPLICITY IS CONTEMPORARY TODAY OR TWENTY YEARS FROM TODAY.

PROVES MUCH LOWER IN COST OVER THE YEARS.

Write for latest P & K catalog . . . and use the P & K advisory and planning services without obligation.

Pfaff & Kendall
84 Foundry Street
Newark 5, New Jersey

"Learn How to Talk," Cautions Editor

Newspaper editor tells public information group what he wants to know about utility industry. Chides PR efforts.

"Are you operating under some sort of self-imposed censorship?" That was one question put to the Public and Employee Information section of the Southeastern Electric Exchange by Loyal Phillips, editor and publisher of the St. Petersburg Independent. There were other questions and a little advice to boot in the editor's candid speech during the recent St. Petersburg, Fla., meeting.

Here are excerpts from Phillips' remarks:

"Without meaning to be presumptuous, I would like to give you my personal impressions of your (electric company) public relations performance in the past.

"You are the jugular vein of our national security and heart beat of our economy. Public-relations-wise, you have acted like a freckle-faced bashful country boy at an ice cream social.

"You spend lots of money to convince the community that utility people are nice people but so far as your company's contribution to the community welfare is concerned, you hide your light under a bushel.

"What were the utility industries doing (during the war) while other American industries were carrying the ball?

"Why doesn't someone tell me these things? Are you operating under some sort of self-imposed censorship?

"Are you preparing the public for rate increases if they must come? Or are you going to sneak up on our blind side and try to do it quietly?

"As a tax-paying John Q. Public, and as one of your customers, there are a lot of things I don't know about your business and your problems. I'd like to ask you a few questions.

"No. 1—Is there anything wrong with public power? Apparently there are a few million people in this country who don't think so.

"No. 2—How about the Dixon Yates deal? Was there anything right about it? If so I hope someone will let me know and explain it to me as though I were a little child.

"I'm on your side, but you shouldn't take me for granted.

"Before the public power boys have you deported from our shores on a trumped up charge that you are an economic liability . . .

"I do hope you will learn how to talk!"

Indianapolis P&L Gets Report Award

H. T. Pritchard, president, Indianapolis Power & Light Co (left), receives the bronze "Oscar of Industry" award for the best 1955 annual report from Weston Smith (right), director, annual report survey, Financial World. Also in the large utilities class, Kansas City Power & Light Co was runner up, and Arkansas Power & Light Co placed third. Awards were made during a banquet held in New York in late October.

Everyone's a Reporter in Kansas P&L Program

Publicity department at Kansas Power & Light Co has all employees on lookout for promising stories which can be used in the employees' magazine or in general news releases.

Of course the department prefers stories directly related to company activities or the use of electricity, but it also handles good story ideas that are a little further afield.

To help employees get their ideas in usable form, the department furnishes "news tip cards." Employees are asked to jot the ideas on one of these cards along with the information available and picture possibilities. The employee signs his name and gives his location in blanks provided on the card.

These tip cards are sent to the publicity department for consideration and possible followup. The department reports that a number of tips have already come in. It hopes the flow will enable the department to obtain more interesting stories for area papers or for use in the employee publication.

Before the new program was initiated, the department had relied primarily on district managers to send news tips along. These men handle release of news material in their areas.

70% STRONGER IN COMPRESSION
1000% MORE RESILIENT
30% LIGHTER

New Westinghouse reactor rated a hands-down winner

Remarkable Westinghouse polyester-glass is stronger, more resilient, more versatile by far than any material ever before used in reactor cleat construction. Stronger, less bulky, and with greater dielectric strength, for instance, than conventional concrete. Cleats are bonded into solid vertical columns by high-strength resin tie rods, another Westinghouse innovation. Equally serviceable indoors or out, polyester-glass is impervious to moisture or any other atmosphere condition. In short . . . damage, aging and therefore maintenance are all but eliminated.

All facts. Tough facts, too, but look what current-limiting reactors have to put up with. Forces generated by short circuits and by expansion and contraction of conductors under heavy overloads subject equipment to terrific thermal and mechanical shock.

In the battle of the short circuits the new Westinghouse dry-type reactor is a hands-down winner. For more facts, get in touch with your Westinghouse sales engineer, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70774-X

The six columns of a typical Westinghouse reactor have the compressive strength to support the weight of the largest power transformer ever built . . . 365,000 lbs.

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***

Readers Endorse Larger Type Size

To the Editor:

We like your new, more readable type very much! It has a "refreshing" appearance or clarity that makes reading it more of a pleasure than ever.

No doubt you will get fewer comments than for something your readers don't like, but probably most everyone will be able to read faster than before. And since time is such a precious thing in our business, you have done the industry a favor. Congratulations and thanks!

J. M. Agnew
District Manager
Public Service Co of Indiana, Inc.
Wabash, Ind.

I like the 10 point type better. It is much easier reading—especially for scanning to find what is of interest.

W. M. Clark
Administrative Officer
Division of Power Engineering and Construction
Tennessee Valley Authority
Chattanooga, Tenn.

The print of the "Electrical World" of Sept. 24 has many advantages over the loss of the 100 words per page.

Joseph A. Schneider
RD4
Steubenville, Ohio

I don't really think there is anything wrong with my eyes—it's just that my arms don't seem to be as long as they used to be. Then, too, it does seem that printing is smaller than it used to be. In short, I do appreciate your 10 point 19 picas format—because I can see it better, read it quicker—and I suppose a great many of the old codgers who read "EW" will also appreciate it.

Daniel W. Willingmyre
Electrical Engineer
U. S. Government Printing Office
Washington 25, D. C.

The ten point type on 19-pica line is perfect for fast reading. I find two fixations per line will do the job. The type face is excellent as the visual angle is ample. Incidentally, what is the face—Century? [Times Roman—Ed]. The white space between columns, around the border, and between lines (a 10-point letter on a 12-point slug) makes for a clean looking page. All in all, it's a great improvement, and I suspect your readers will go for it.

The benefit to editing should be as great as to reading. Certainly, an editor faced with a space problem will edit tighter. And that becomes a rewarding benefit to the reader. So, all in all, everyone benefits: the reader, the editor, the information source.

H. C. McDaniel, Manager
Technical Information
Westinghouse Electric Corp
Pittsburgh 30, Pa.

In my opinion, the larger type is much better than the old and well worth the small reduction in the number of words per page. In fact, for most of us, it is impossible to read the entire text of an article in most cases, and we would suggest that if the length of the article could be shortened a little so as to go on the same number of pages, this would be, in itself, an advantage.

The subject of "readability" has been lately under considerable study, as you know, and more effort should be expended in achieving results of this kind.

M. G. Leonard, Section Manager
Distribution Transformer Eng.
Westinghouse Electric Corp.
Sharon, Pa.

• The success of our experiment with 10 on 12-point type on a 19-pica line has convinced EW that serious consideration should be given to the type size used in next year's book.

Tesla Article Draws Appreciation

To the Editor:

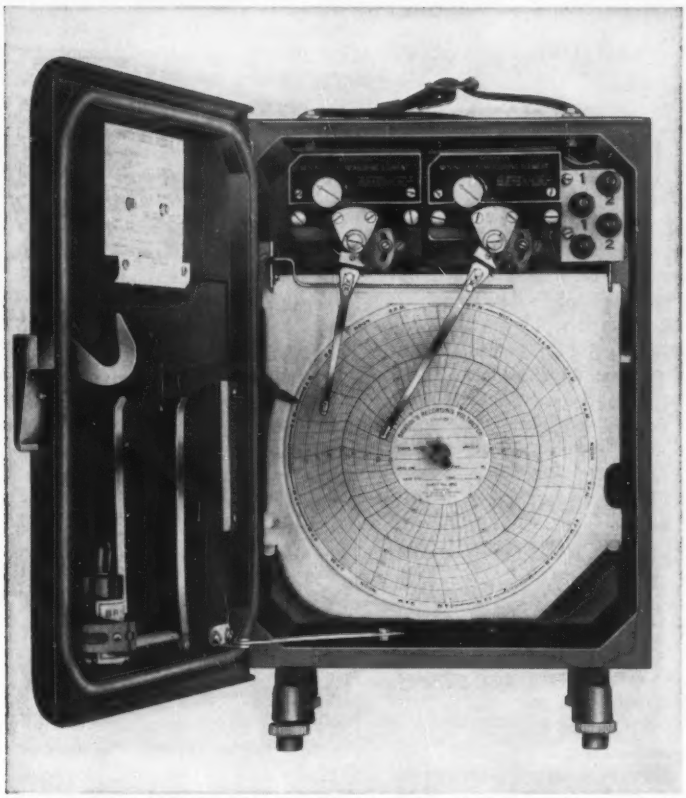
The tribute to Nikola Tesla which appeared in the Sept. 17 issue was most interesting.

I would like to suggest to your editorial department that consideration be given to similar articles for future issues. Articles dealing with the historical side of the electrical industry as well as biographical sketches of men who had part in advancement of the art would, I am sure, be appreciated by readers.

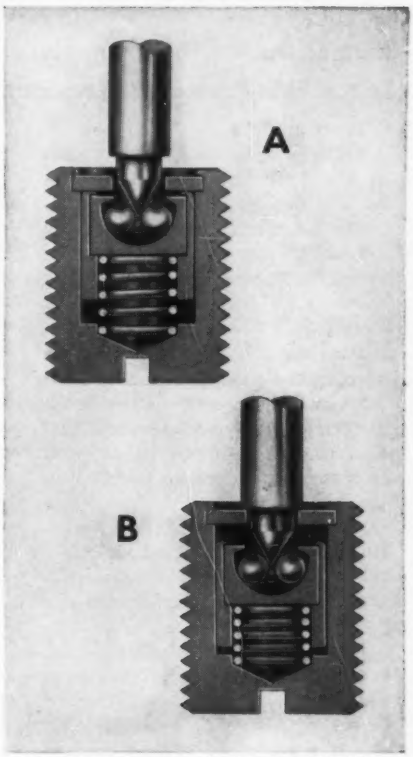
Armond W. Behm
Behm Electric
Lomira, Wisconsin

New! Two-pen Voltmeter

Two rugged reliable moving-iron elements provide independent records to ±1% on single chart: Similar two-pen ammeter available



BRISTOL'S® TWO-PEN VOLTMETER. Portable (*shown*) is ideal for on-the-spot checks requiring two simultaneous voltage records. Also available for portable and pole mounting use and for permanent installations.



SHOCKPROOF BEARINGS. Shock-mounted ball bearings support pivots at front and rear of the rugged moving-iron measuring element. In normal use (A) spring holds bearings against pivot. Under mechanical shock (B) spring absorbs impact.

Here's the ideal instrument for on-the-spot simultaneous records of two a-c voltages—either related or independent.

Bristol's new two-pen voltmeter has the same rugged moving-iron measuring elements as Bristol's standard electrical instruments. But there are *two* elements with *two* pens, providing *two* independent records on a two-zone chart!

The new voltmeter provides easy-to-read visual records and is valuable for such uses as checking the balance on single-phase three-wire systems and for visualizing voltage regulation. Available for portable, portable and pole mounting or for wall, switchboard, or flush-panel mounting. Two-pen ammeter model is ideal for portable use with split-core current transformers.

Here are some outstanding features of this new Bristol instrument:

High accuracy—±1% of full scale.

Two high-torque moving-iron mechanisms—Bristol's moving-iron mechanism produces greatest torque possible while keeping weight and power drain to a minimum. Assures positive recording over full range.

Low electrical burden—Only 5.5 volt-amperes at 120 volts or 12 volt-amperes at 240 volts for each voltmeter mechanism. Only 5 volt-amperes at 5 or 10 amps for ammeter.

High stability of calibration—Bristol's moving-iron mechanism is inherently stable, seldom requires calibration.

Easy calibration in field—Recalibration, if necessary, is easily accomplished by user without special tools or skills.

Rugged construction includes shockproof bearings, locking device to prevent pen movement in shipping or while carrying portable models.

Leveling not critical.

Write for complete data on this outstanding recording voltmeter today. The Bristol Company, 116 Bristol Road, Waterbury 20, Connecticut. 6-27

BRISTOL *TRAIL-BLAZERS IN PROCESS AUTOMATION*

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

Money Rates: Factor in Utility Common

Dividend increases would provide cushion against market decline for a number of utility common stocks, Ted Locke, utility specialist, Goodbody & Co, tells clients

Market for electric utility common stocks is in transition with the outcome depending on the further increase in interest rates. That's the sum-up of the current market situation made by Theron W. Locke, utility specialist for Goodbody & Co, New York City.

For some time now Locke has been advising Goodbody clients that interest rates are the key to appraising the market for utility securities and that tight money conditions are expected to continue for some time. His purchase recommendations have been based on relative yields, with special emphasis on the improved yield that could develop from dividend increases. But his watchword is "caution."

In a recent research study mailed out to clients, Locke notes that earning reports for utility common are favorable. The year 1956, he says, should prove to be a good one for the utilities despite the numerous wages increases and other cost increases that have taken place. This momentum, he continues, should carry well into and quite possibly through most of the upcoming year 1957.

Here are Locke's general conclusions:

"We are optimistic as to both the near term and the longer term outlook for continued earnings growth of the utility industry. The chief problem at present is the rising interest rates. But yields are still low on many utility stocks and the adjustment to higher yields will take place stock by stock rather than all at once. Some utility stocks may have already adjusted to a large part of the rise in yields necessary to offset the higher rates—others have a long way to go.

"We can see where the increase in yields resulting from dividend increases may provide an important cushion against market decline for a number of utility stocks. That is why we consider dividend increases so important. For without the prospect of a dividend increase within a few months, some utility stocks may have to decline considerably to get in line with the general level of yields for their respective quality groups.

"Since it now seems to be a general belief that interest rates may rise still further over the next few months, we cannot take other than a very cautious view toward the market outlook for utility stocks. Higher money rates seem bound to limit price appreciation over the next few months. That is why we are very cautious about suggesting purchase except for yield purposes.

"As stock after stock develops a higher yield either through price decline or increased dividend, we expect to suggest purchase for income and there will be a point where the group as a whole will again be a buy for appreciation purposes. But meanwhile we expect to do some switching from stocks that are not in a favorable position to increase their dividend or where even a fairly good dividend increase would not raise the yield adequately.

"We would point out," Locke concluded, "that in a number of cases only a moderate decline in price would be necessary to cause a utility stock to yield 6% on the dividend increase that seems likely within a reasonable time."

Since the study was released in mid-October, Locke reports, "a number of utility stocks have declined to a point where they have offset to an appreciable extent the objections voiced in the report and are becoming increasingly interesting."

Venezula Power Companies Reduce Rates By 15%

Caracas — (McGraw-Hill World News)—La Electricidad de Caracas, Venezuela's biggest power company, will lower rates to 87,000 domestic consumers in Caracas an average of 15 per cent by agreement with the government.

Luz Electrica de Venezuela, subsidiary of American & Foreign Power serving 75,000 household customers in the Venezuelan capital, has indicated that it will follow suit.

The reductions will cost the two companies an estimated $1.5 million each in annual revenue, although increased consumption is expected to make up for the loss eventually. A rate cut of at least 10 per cent for industrial users of electricity is under study and is expected to go into effect sometime next year.

New rates based on peak demand were worked out by representatives of La Electricidad, the Ministry of Development and the Venezuelan Development Corporation (CVF), a government agency. La Electricidad had previously agreed to the reduction under terms of a CVF loan for expansion of generating facilities.

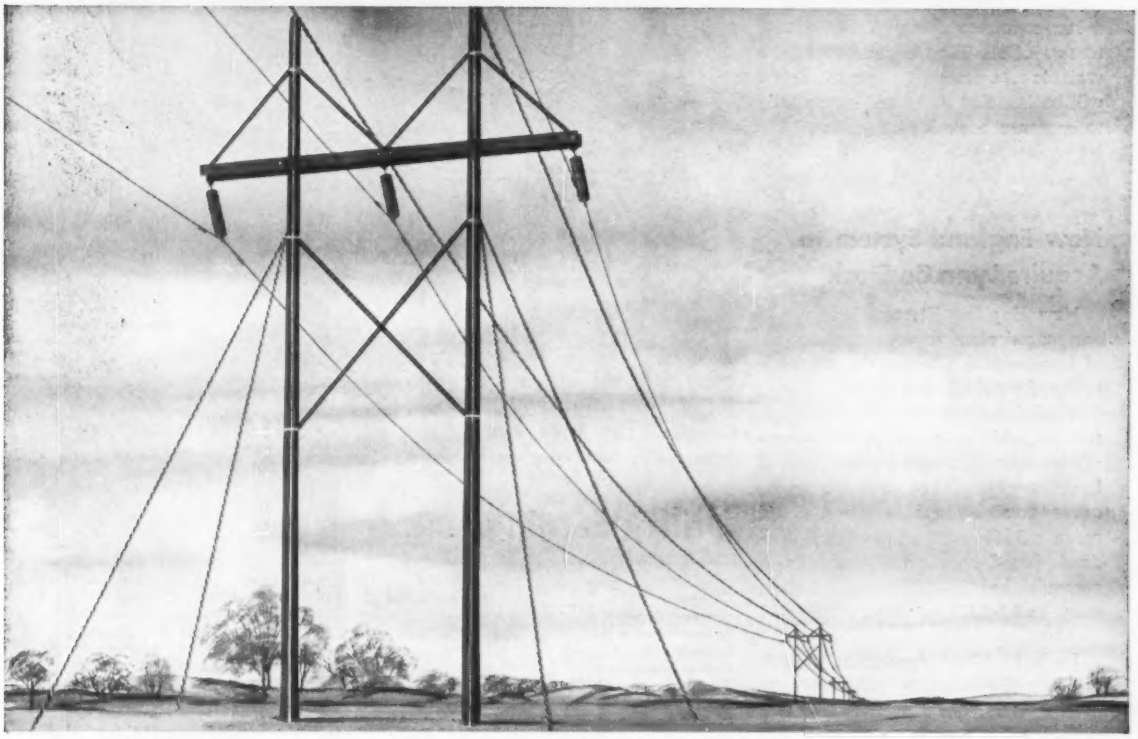
The company expects to put the new rates into effect within two months. Luz Electrica de Venezuela, which buys all but a fraction of its power from La Electricidad has 32 different rate scales, based on number of rooms and electrical outlets in homes, and Luz Electrica has 17.

The new charge is a minimum of $1.26 monthly for 14 kwh or less; 6.75¢ for each additional kwh up to 120 kwh; 4.5¢ per kwh up to 240 kwh; and 3¢ per kwh beyond that.

Customers using more than 120 kwh monthly will pay a rate varying according to peak load. For each kw of peak demand in excess of 2 kw, 60

(*Continued on page* 260)

GALVANIZED STEEL STRAND



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Venezuela Rate Cut

(*Continued from page* 258)

kwh will be added to the total chargeable at the rate of 6.75¢, and 60 kwh to the total chargeable at the rate of 4.5¢.

An estimated 5,000 domestic customers of La Electricidad fall in the variable-rate category. Special meters will be installed in homes temporarily to measure peak load.

New England System to Acquire Lynn Co Stock

New England Electric System has announced plans to acquire the stock of Lynn Gas & Electric Co following approval by the Securities & Exchange Commission. The New England System proposes to exchange two shares of its common stock for one share of Lynn common. The proposal to be offered to all Lynn shareholders would mean a 25% increase in annual dividends based on current rates. Lynn common has been earning $1.60 a share and NEES has been earning $1 a share.

Irwin L. Moore, president, NEES, said the Lynn utility geographically fits into the New England operating picture. The System with its many and varied sources of power is in a position to provide the additional energy needed in the Massachusetts North Shore territory to take care of rapidly increasing demands of Lynn's customers, Moore continued.

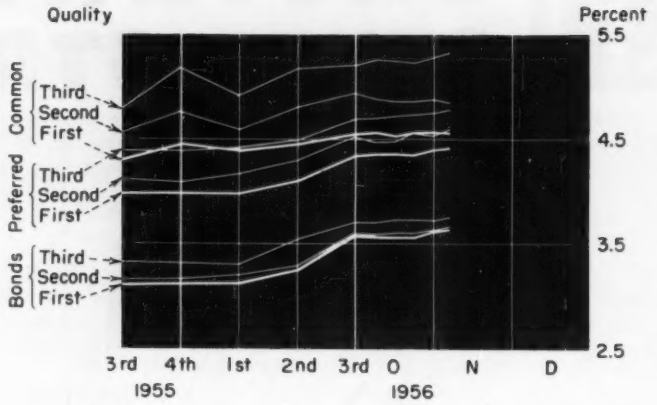
Lynn now has 47,000 electric customers and 44,000 gas customers. It operates in six cities and towns. NEES, largest utility in New England, has 740,000 electric customers and 200,000 gas customers.

FINANCIAL BRIEFS

Southwestern Public Service Co will pay December 1 a quarterly common stock dividend of 35¢ a share as compared with 33¢ previously.

National Association of Railroad and Utilities Commissioners will hold its annual convention in the Peabody Hotel, Memphis, Tenn., on Oct. 28-31, 1957.

Today's Utility Yields (%)



	Bonds			Preferred Stocks			Common Stocks		
Quality	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Nov. 1	3.64	3.65	3.75	4.42	4.58	4.78	4.54	4.85	5.32
Oct. 25	3.61	3.62	3.72	4.40	4.52	4.73	4.55	4.87	5.28
Oct. 18	3.57	3.60	3.72	4.36	4.53	4.72	4.53	4.84	5.21

Utility Earnings . . .

Company	Period Months	Ended	Net Income 1956	Net Income 1955	Earnings Per Common Share 1956	Earnings Per Common Share 1955
Alabama Power	12	Sept.	$15,205,132	$13,620,615	$....	$....
Baltimore Gas & Electric	12	Sept.	15,650,000	14,314,000	2.27(a)	2.20(a)
Central Illinois Electric & Gas	12	Sept.	3,090,074	2,699,465	2.35	2.02
Central Illinois Public Service	12	Sept.	9,098,716	8,610,695	2.44	2.29
Central Maine Power	12	Sept.	6,376,515	6,958,202	1.65	1.84
Central Power & Light	12	Sept.	7,786,249	7,059,661	....	....
Community Public Service	12	Sept.	1,480,403	1,459,077	1.80	1.78
Consolidated Edison of New York	12	Sept.	52,605,480	51,426,376	3.14	3.06
Consumers Power	12	Sept.	31,097,342	28,013,022	3.31(a)	3.11(a)
Dallas Power & Light	12	Sept.	8,009,654	7,051,162	....	....
Delaware Power & Light	12	Sept.	5,865,186	4,929,983	2.54(a)	2.23(a)
Georgia Power	12	Sept.	15,042,495	13,737,681	....	....
Gulf States Utilities	12	Sept.	11,035,566	10,251,360	2.20(b)	2.07(b)
Interstate Power	12	Sept.	2,974,971	2,842,112	1.04	1.00
Iowa Southern Utilities	12	Sept.	1,478,291	1,343,532	1.81	1.63
Kansas Power & Light	12	Sept.	6,725,977	5,204,467	1.96	1.43
Kentucky Utilities	12	Sept.	6,022,465	6,146,559	....	....
City of Lafayette, La	12	Aug.	748,823(c)	567,897(c)	....	....
Long Island Lighting	12	Sept.	12,547,903	10,566,906	1.55(f)	1.37(f)
Middle South Utilities, consolidated	12	Sept.	16,143,213	14,303,850	2.12	1.88
Niagara Mohawk Power, consolidated	12	Sept.	29,389,690	29,407,979	2.22	2.22
Pennsylvania Power & Light	12	Sept.	24,164,307	21,830,959	3.44	3.05
Philadelphia Electric	12	Sept.	34,733,720	32,255,929	2.53(g)	2.33(g)
Public Service of Indiana	12	Sept.	13,498,760	12,631,587	2.43(h)	2.42(h)
Quebec Power	9	Sept.	906,511	816,093	1.35	1.22
Shawinigan Water & Power	9	Sept.	8,210,172	6,368,202	3.06	2.32
Southern California Edison	12	Sept.	31,512,134	28,804,610	3.20(i)	3.17(i)
Southern Indiana Gas & Electric	12	Sept.	2,320,373	2,523,646	1.92(j)	2.31(j)
Texas Utilities, consolidated	12	Sept.	27,509,330	23,680,105	2.25(k)	2.01(k)
Utah Power & Light	12	Sept.	7,538,202	6,742,515	3.40	3.04
Virginia Electric & Power	12	Sept.	20,602,989	18,897,059	2.72	2.52
Western Light & Telephone	12	Sept.	1,749,995	1,523,324	3.03(l)	2.67(l)

Notes—(a) Based on average shares; (b) Based on 4,321,832 shares in 1956 and 4,221,832 shares in 1055; (c) Balance available for capital expenditures; (f) Based on 6,899.416 shares in 1956 and 6,406,131 shares in 1955; (g) Based on 12,196,310 shares in 1956 and 12,164,078 shares in 1955; (h) Based on 4,531,938 shares in 1956 and 4,251,060 shares in 1955; (i) Based on 8,039,647 shares in 1956 and 7,453,760 shares in 1955; (j) Based on 996,363 shares in 1956 and 913,333 shares in 1955; (k) Based on 12,210,000 shares in 1956 and 11,810,000 shares in 1955, and (l) Based on 495,037 shares in 1956 and 458,091 shares in 1955.

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Any utility field man who has installed a Fisher-Pierce photoelectric control knows firsthand the many advantages of its clean, straightforward design. He appreciates, for example, time-saving plug-in installation of the one-piece electronic head; the ease, speed and safety with which he can handle compact F-P controls; the clean meter plate that has nothing to interfere with external wiring; the easily checked fuse. He knows the weatherproof glass enclosure design gives him quick, easy access to the control chassis; that he can orient an F-P control after mounting; and that component layout permits trouble-free servicing as well as maximum impulse strength. These advantages are important to the utility itself as well as the field man, since they mean rapid, low-cost installation and substantially reduced maintenance. Only F-P controls provide these advantages, *plus* these four other important features:

Series 64400

Series 63300C

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ADAPTABILITY — Three basic series and numerous models for all mounting requirements, operating voltages, load capacities and desired contact arrangements.

DEPENDABILITY — Proven by the thousands of F-P controls used by hundreds of utilities, over the past ten years.

Complete specifications and operating data are contained in informative F-P Bulletins, available on request. Or call the Fisher-Pierce sales representative in your area, for point-by-point proof of F-P superiority.

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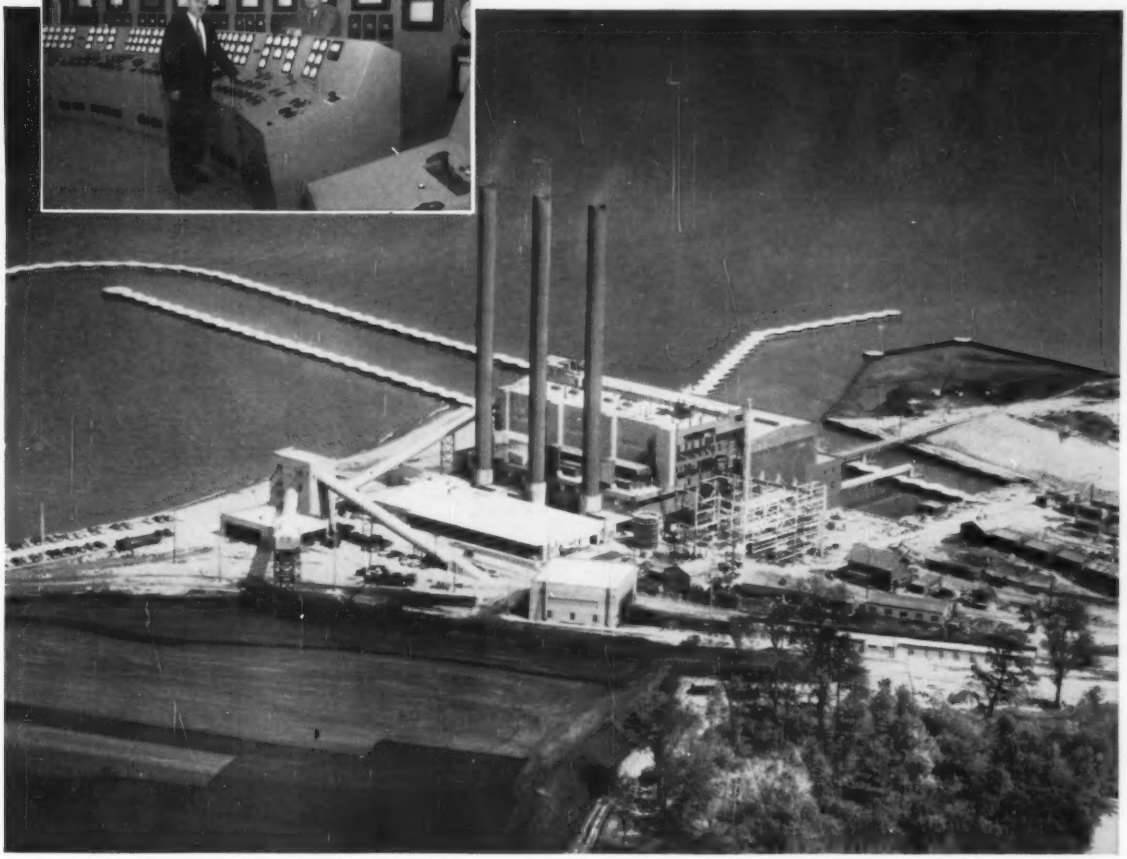

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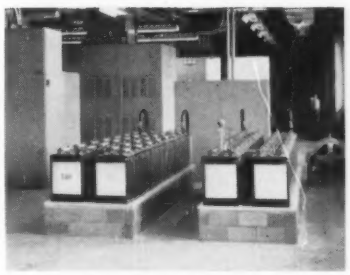

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